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Object Detection Radar Prototype with Ultrasonic Sensor Using Iot-Based Arduino

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Abstract

Internet of Things (IoT) is a concept that aims to expand the benefits of connected internet connectivity. Internet of Things (IoT) refers to objects that are uniquely identified as virtual reservations in an internet-based structure. At this time, the limitation of surveillance control in observing objects as negligence of the limitation of view, light conditions or obstructions becomes a problem in application and monitoring. The use of radar is one solution to overcome this condition. Radar stands for radio detection and range is a device whose function is to determine the distance, direction, or speed of a moving and fixed object. Radar can be used in mapping applications and exploration of objects in unknown space. The use of radar can also help navigate moving objects. In this study, a radar prototype with ultrasonic sensors and a simcard module was made that can provide notification via SMS if an object is near the radar. It is hoped that this radar prototype can be used to identify the location of the presence of obstructive objects in rooms with limited access or in dangerous areas.

I. INTRODUCTION

The internet is a new world that is full of charm when it first appeared and was first introduced, the internet continues to attract further exploration, exploration and development by technology experts. Along with the development of internet infrastructure, not only smartphones and computers can connect to the internet. However, various kinds of real objects will be connected to the internet. Examples of this could be electronic equipment, equipment used by humans, and including any real object which is all connected to local and global networks through embedded, always-on sensors. In the world of "IT", this concept has been known as the "Internet of Things" or what is called the IoT acronym. Internet of Things (IoT) is a concept that aims to expand the benefits of internet connectivity that is connected continuously. Internet of Things (IoT) refers to objects that are uniquely identified as virtual reservations in an internet-based structure. Internet of Things (IoT) as a global network infrastructure, which connects physical and virtual objects through the exploitation of data capture and communication capabilities with sensors and connections as a service development. In this case, it can be concluded that IoT refers to and utilizes an object which later on these objects will be able to communicate with one another via an internet network. At this time, limited vision in detecting the presence of objects as a result of limited visibility, light conditions and obstructions is a problem in control and monitoring applications. The use of radar is one solution to overcome this condition. Radar stands for radio detection and ranging is a device that functions to determine the distance, direction, or speed of a moving and fixed object. Radar can be used in mapping applications and exploration of objects in unknown space. The use of radar can also aid in the navigation of moving objects. Radar implementation can take advantage of the principle of emission and reflection of electromagnetic waves or sound waves at certain energy levels and time intervals. By applying mathematical computations, a visual representation of the object being observed will be obtained. The choice of method and the use of the detector material is adjusted to the conditions of the object's presence, namely barrier or without barrier. The accuracy of detection and detailed information on object dimensions are performance measures that must be achieved in radar implementations while still paying attention to the efficiency of radar prototypes as

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detecting stationary objects using ultrasonic devices and computation. In this study, a radar prototype with ultrasonic sensors and a simcard module was made that can provide notification via SMS if an object is near the radar. This radar prototype is expected to be used to identify the location of objects and obstructions in rooms that have limited access or dangerous areas. Based on the background that has been explained, the writer will make a study with the title "Prototype Radar for Object Detection with Ultrasonic Sensor Using Arduino Based on IoT".

II. RELATED WORKS/LITERATURE REVIEW (OPTIONAL)

Arduino Uno

[1] Arduino is a software and hardware platform. Arduino hardware is the same as a microcontroller in general, only the Arduino adds the pin naming so that it is easy to remember. Arduino software is open source software so it can be downloaded for free. This software is used to create and enter programs into Arduino. Arduino programming is not as many as conventional microcontroller stages because Arduino has been designed to be easy to learn, so beginners can start learning microcontrollers with Arduino (Sulaiman, 2012: 1). [2] Arduino is an electronic kit or open source electronic circuit board in which there is the main component, namely a microcontroller chip with the AVR type from the Atmel company. [1] Arduino is an open source platform both in hardware and software. Arduino consists of megaAVR microcontrollers such as ATmega8, ATmega168, ATmega328, ATmega1280, and ATmega 2560 using 16 MHz crystal oscillators, but there are several types of Arduino that use 8 MHz crystal oscillators. The power supply needed to supply the minimum Arduino system with a voltage of 5 VDC is sufficient. Arduino Atmega series port consists of 20 pins which include 14 pins of digital I / O with 6 pins that can function as PWM (Pulse Width Modulation) outputs and 6 pins of analog I / O. Arduino's advantage is that it doesn't need an external flash programmer because the Arduino microcontroller chip is filled with a bootloader which makes the upload process simpler. For connection to a computer, you can use the RS232 to TTL Converter or use a USB Chip to Serial converter such as FTDI FT232.

Software Arduino

[1] Arduino was created for beginners and even those who don't have a basic programming language at all because it uses the C ++ language which has been made easy through the library. Arduino uses processing software which is used to write programs into Arduino. Processing itself is a combination of C ++ and Java languages. The command structure on Arduino generally consists of 2 parts, namely void setup and void loop. Void setup contains commands that will be executed only once since arduino is turned on, while void loop contains commands that will be executed repeatedly as long as arduino is turned on.

Arduino software can be installed on various operating systems (OS) such as: LINUX, Mac OS, Windows. Arduino IDE software consists of 3 parts:

1. Program editor, for writing and editing programs in a processing language. The program listing on the Arduino is called sketch.
2. Compiler, a module that functions to change the processing language (program code) into binary code because binary code is the only programming language understood by the microcontroller.
3. Uploader, a module that functions to enter binary code into the memory of the microcontroller.

Microcontroller

[3] Microcontroller is a gadget that is used to control several methodologies or parts of a domain. A microcontroller is a highly coordinated programmable chip that is preferably suited for control applications. [4] A microcontroller is a microprocessor system in which there is already a CPU, ROM, RAM and I / O. Other internal tools that are well connected and organized by the manufacturer and made on one chip that is ready to use. So we just have to program the contents of the ROM according to the rules for use by the factory that made it. [5] A microcontroller is an electronic device in the form of an IC (integrated circuit) which has the ability to manipulate data (information) based on a sequence of instructions (programs) created by the programmer. Microcontroller is an example of a simple computer system that is contained only in one chip.

Processing IDE

[6] Processing is the name of a programming language intended for computers. This programming language was designed by Casey Reas and Ben Frey at the Massachusetts Institute of Technology (MIT) in 2001.The aim is to make it easier for anyone without a computer science background to handle things like the following:

1. Figs.

2. Animation.
3. Sound.
4. Videos.
5. Hardware.

Using only a small amount of code, visual results can be obtained. This is different from other languages which tend to prioritize only text processing such as Arduino Processing which is also equipped with an IDE.
You can create programs (which are also called sketches in particular) through the text editors available in the IDE. You can also run a sketch via the IDE. By using Processing, applications on computers can be made easily and quickly. More importantly, the application can be connected to the Arduino. Thus, the information that comes from the sensor can be monitored on a computer with an attractive appearance.

Internet of Thing

[7] Internet Of Things (IoT) is a hot topic discussed at this time. This is triggered by the rapid development of electronic technology of various sizes. In addition, electronic equipment is generally equipped with a network module that allows equipment or what is known as "Things" to be connected to the internet network. In simple language, the concept of the Internet of Things (IoT) can be described as the connection of a physical object to the internet network. This physical object can be an electronic device that performs sensing or an actuator.

III. METHODS

Research Workflow

This research workflow is illustrated in Fig. 1:

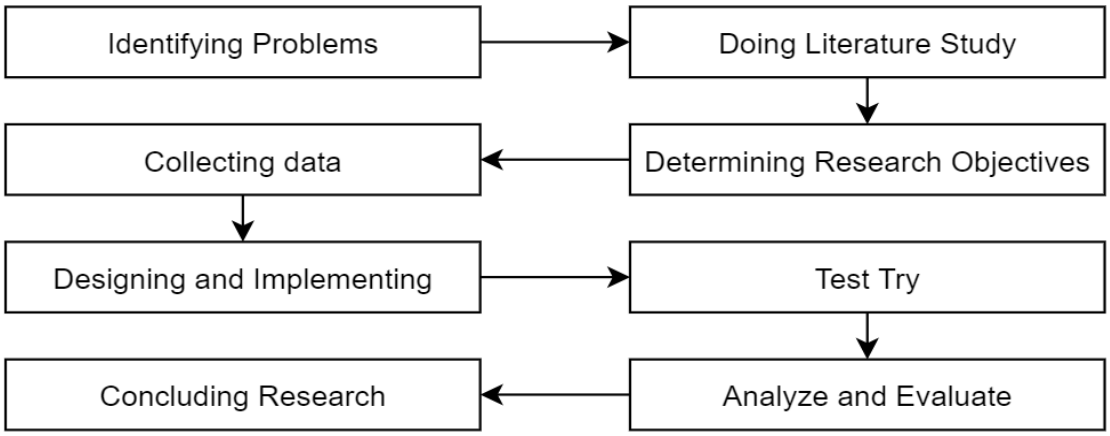

Figure 1 Research Workflow Diagram

1. Identifying Problems
   Identifying a problem to be researched, namely:
   a. Limitations of sight in detecting the presence of objects as a result of limited visibility, light conditions and obstructions.
   b. The high detection accuracy and detailed information on object dimensions are performance measures that must be achieved in radar implementations with due regard to efficiency.
2. Doing Literature Study
   Conducting a literature study related to the problem to be researched is continued by determining the research objectives so that the research does not spread to other scopes, namely:
   a. Document study, namely collecting data by studying and analyzing books, files and documents, written or printed regulations as a source of information about theories related to research problems and the objects to be studied.
   b. Field research This field research is used to observe the condition of the environment around the object that will be used as a place of research, as well as to interact with the people in that environment.

3. Collecting data

collecting data or samples to be studied is continued by designing and implementing using samples that have been collected where the design and implementation are in accordance with predetermined research objectives such as:

a. The design of this object detection radar uses a microcontroller and is based on IoT
b. Objects / objects detected are solid objects
c. The design and manufacture of this object detection radar are used to detect objects that are 10-40 cm away.

4. Determining Research Objectives
   Furthermore, determining the research objectives. The following are the objectives of the research:
   a. Implementing the prototype object detection system with ultrasonic sensors in the form of radar using IoT-based Arduino.
   b. Make it easier to recognize moving objects that approach the radar.
5. Designing and Implementing
   Then, the method that has been designed and implemented is tested and in the final stage, the analysis and evaluation of the method is carried out so that conclusions can be drawn on the research.
6. Test Try
   Testing the test by conducting Black Box Testing to test the success of the running of a series of tools in this design.
7. Concluding Research
   In this stage contains points in the form of conclusions obtained from the stages of analysis and design.
8. Analyze and Evaluate
   In this stage, it contains the views and origins of what the reader can do and do in the future.

Algorithms and Methods

The following is an algorithm for how to run from the device which is described as a flowchart below:

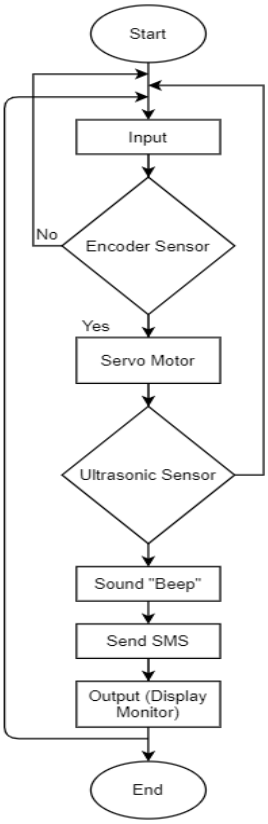

Figure 2 Flowchart Hardware

Designing Tool Connection Circuit

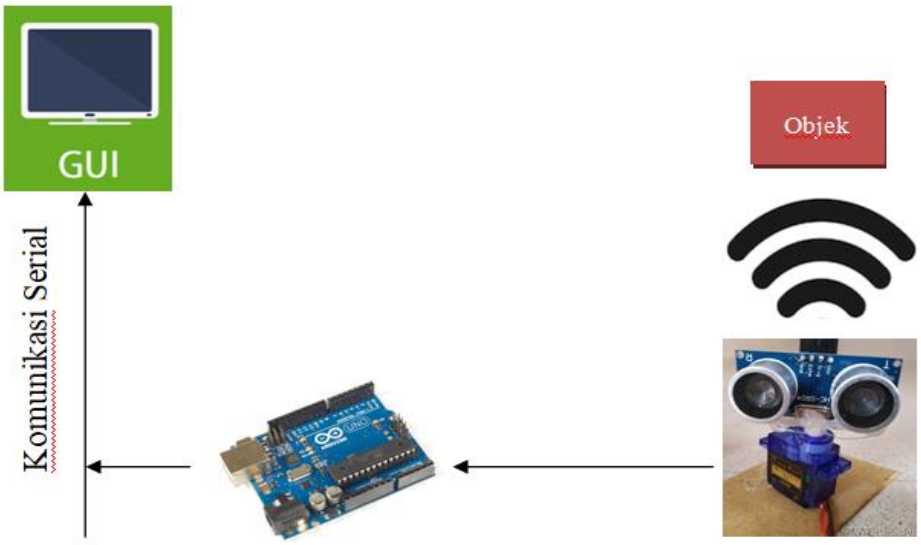

Figure 3 Schematic of Object Detection Radar Prototype Using Ultrasonic Sensor Using Arduino Based on IoT

The detected object will be displayed on the GUI in the form of the object's distance from the sensor and the object's height from the ground. If the object is not detected by one or all of the sensors, the GUI will not display the scan results. To show the detected object is used and will take the distance data from the ultrasonic sensor, then process the data into pixels which are combined and used to display a line of sight to the detected object.

Screen Design

The following is the application design and the buttons described by the storyboard as follows:

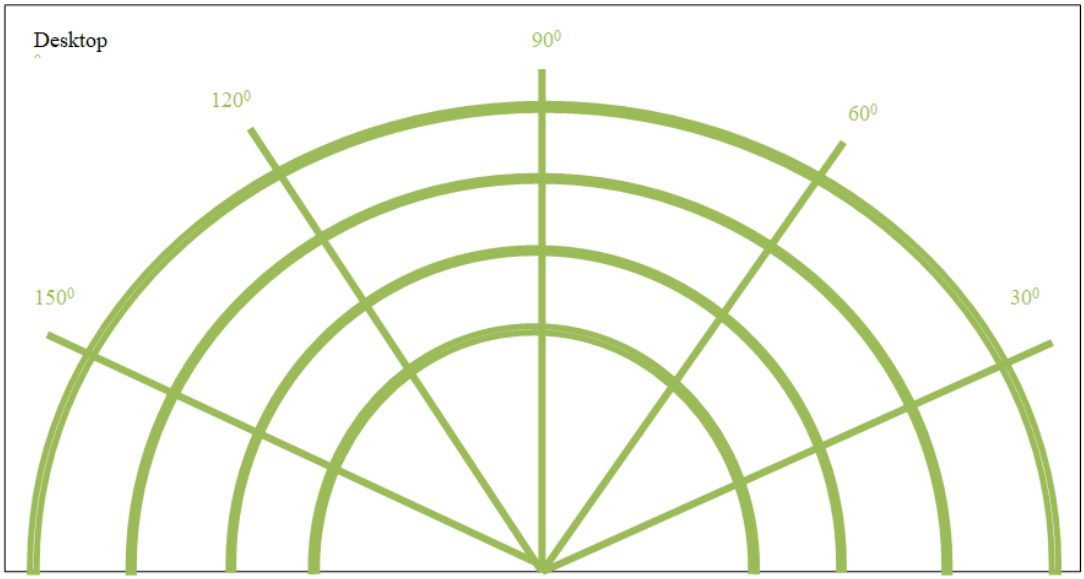

Figure 4 Storyboard for Object Detection Radar with Ultrasonic Sensor Using Arduino Based on IoT on Desktop

In Fig. 4 is a GUI display that is created, where an object whose position is between the three radar sensors and detected by the radar sensor as in Figure 4. Based on the GUI information in Figure 4., it can be seen that the object is 0 cm with a height of 8 cm and an angle of 60o from radar sensor. The green line shows the direction of the radar sensor when making a detection while moving.

IV. RESULTS

Program View

On screen displays and menus can be created via Application Processing 3. Here's what the program looks like:

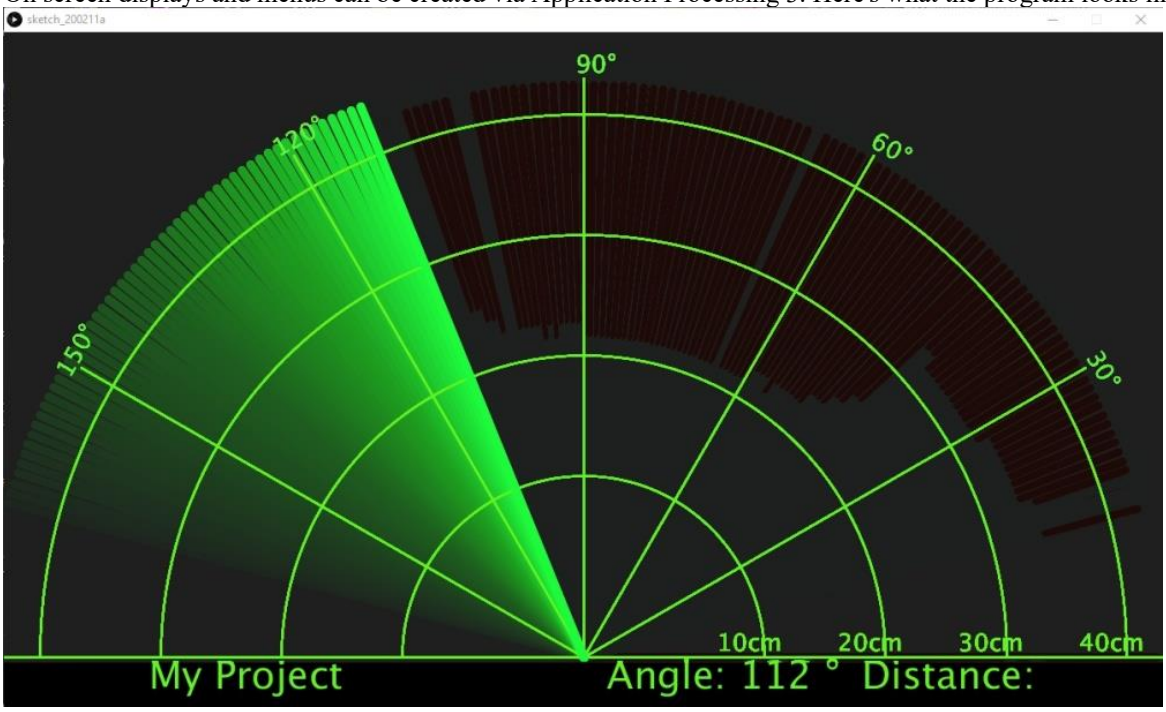

Figure 5 User Interface for Object Detection Radar with Ultrasonic Sensor Using Arduino Based on IoT on Desktop

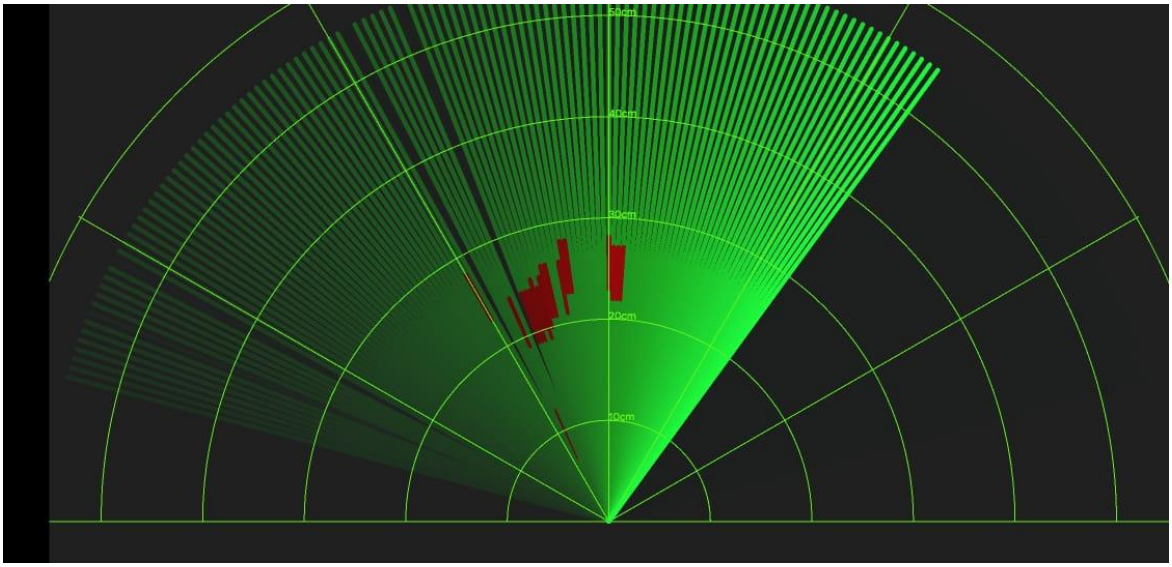

Figure 6 User Interface for Object Detection Radar with Ultrasonic Sensor Using Arduino Based on IoT on Android

The results section and the following discussion section allow the most flexibility in terms of organization and content. In general, the pure, unbiased results should be presented first without interpretation. These results should present the raw data or the results after applying the techniques outlined in the methods section. The results are simply results; they do not draw conclusions.

The following is an interface display of the tools in object detection radar design, such as displays of a series of tools used in the design.

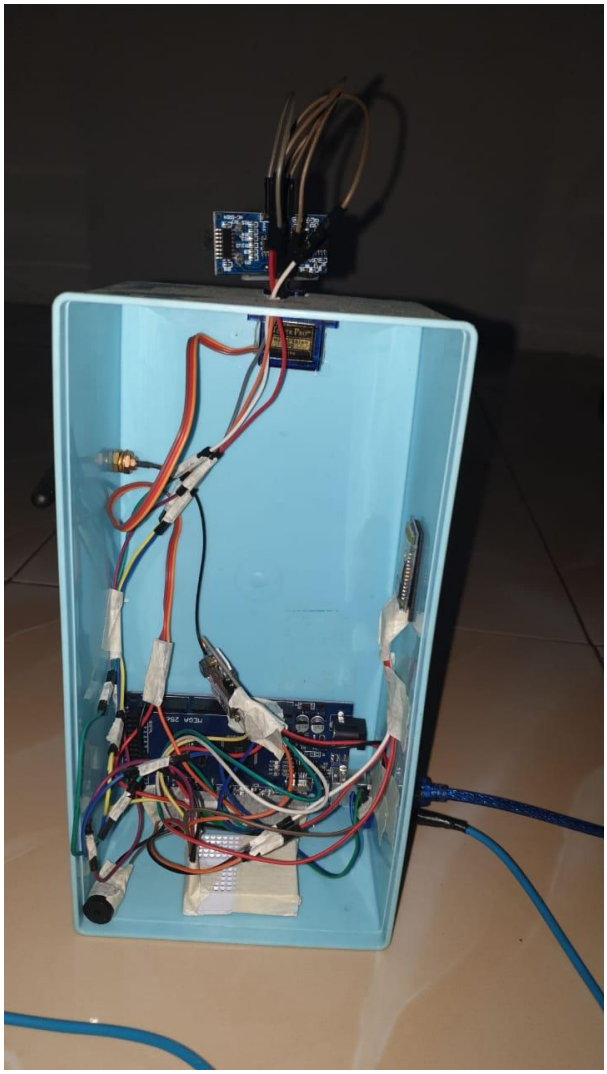

Figure 7 Permanent Tool View

V. CONCLUSIONS

Based on the results obtained in writing this thesis, the following conclusions are obtained:

1. Radar detecting objects can help overcome the limitations of sight in detecting and identifying the presence of an object within the scope of the radar.

2. By using an object detection radar prototype with an ultrasonic sensor using IoT-based Arduino, it can make it easier to find moving objects and display them in the form of SMS notifications.

3. The results of the respondents' answers to the questionnaire that averaged over 50% in choosing the answer "YES". These results indicate that this application is easy to use and makes it easier to recognize moving objects that are approaching the radar.

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