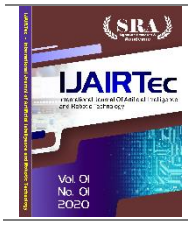

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EXPERT SYSTEM OF ARDUINO MICROCONTROLLER-BASED CATTLE CAGE SAFETY DETECTION WITH INFRARED PROXIMITY SENSOR

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Abstract
Scurity is a basic need of the community in the current era of progress that is used to secure valuables. Scurity system is a security that has a circumcision that has been processed in the sense that it has been systemized according to its application in society or in an environment that is in accordance with its field. Farmers in the community are currently still troubled by the rampant theft of livestock. The rampant theft is also one of the factors in developing a security system, both data theft and theft in the form of goods or even livestock. The data collection methods used are observation, documentation, interviews, and literature studies. Making an Artificial Intelligence security system for Arduino-based livestock pens can provide reliable livestock cage security, because theft will be immediately accessed before carrying out the action. The design of the tool with this security system can provide information to the owner of the livestock shed that there is a thief approaching so that it can be used to maintain the safety of the livestock shed from theft.

I. INTRODUCTION

Scurity is a basic need of the community in the current era of progress that is used to secure valuables. Scurity system is a security that has a circumcision that has been processed in the sense that it has been systemized according to its application in society or in an environment that is in accordance with its field. There are many basic things that make the formation of a security, one of which is due to threats, this is what encourages many people to need security for their daily lives,

it is undeniable that there have been many ways that have been done to minimize a crime but still crimes'also occur one after another. The rampant theft is also one of the factors in developing a security system, both data theft and theft in the form of goods or even livestock. Thefts that disturbed residents were initially only handled by forming a manual security system as arranged by night ronda in turn, but thefts still continued to occur so that technology emerged that made the livestock shed security system efficient and was expected to help eliminate residents' unrest.

Various systems are designed automatically to assist human activities in regulating maximum environmental safety. Advances in electronic technology also help in the development of reliable security systems. One of them is the application of a security system in the field of animal husbandry, especially for security in livestock pens. Various kinds of electronic devices are used for livestock cage security systems, such as theft detection devices, detection of wild predators coming and many more tools on the market. However, the tools that are commonly found in the market are sold separately and the price is relatively more expensive, making people feel objectionable to using them. So an Arduino-based livestock shed security system appeared using proximity sensors. This system can be used to detect the presence of suspicious things within a certain distance by giving a sign through the siren so that the cage owner can find out. The Arduino-based security system has the ability to operate continuously and can work as long as the livestock shed owner wants it or can work for 24 hours. This livestock shed safety problem can be solved with a security system that can notify homeowners through audio call notifications when pyroelectric sensors detect a person approaching the cattle shed when the room is locked.

Some of the results of previous studies that made the livestock cage security system that will be a reference in writing this research report are: Research entitled "Arduino Uno Microcontroller-Based Cage Safety Device" Arduino uno Microcontroller-Based Chicken Coop Safety Device is able to send cage information, namely from 70 attempts to produce 70 messages to the cage owner's handpone with a vulnerable time of 3 seconds. (Bagye Wire, 2018). The research entitled "Design and Build a microcontroller-based livestock theft detection system (Case Study in Bontonompo District, Gowa Regency)" The results of this tool design are to find out and track the position of the presence of livestock when they leave the pen or there is a theft in the livestock so that owners can take quick steps to find out the location of their livestock. (Ichsan MN, 2019).

The method used in this study is to use the literature and observation method where the author collects supporting references in the form of library books, scientific journals, and makes observations on the farmer's environment in carrying out a security system. With the creation of an Arduino-based livestock shed security system, it is hoped that it can reduce public unrest about the theft of their livestock. By using this Arduino-based livestock shed security system, the farmer gets a signal in the form of a siren sound when a thief approaches the livestock pen, so that the farmer can take reasonable actions to avoid theft or even be able to catch the thief.

II. LITERATURE REVIEW

2.2. Past Research

Harjanto and Leonardi (2017) their research with the title Design and Build a Door Open System Using a Password Based on an Arduino Microcontroller. The door open and close application system using a microcontroller-based password code is one of the electronic security systems designed to provide security solutions in buildings or buildings. This research is the result of the design of a prototype system to open and close the door using a password based on an Arduino microcontroller. The manufacture of tools is carried out as one of the efforts in technological advances for security systems. The components used in this design are arduino nano, Lcd 16x2, Membrane Matrix Keypad 4x3 7 input, IC 74HC595, Buzzer 5v and servo motor. While the software used is fritzing and Arduino ID, based on the results of measurements and tests, the system on the tool is made able to open and close doors automatically using a password. The door can open for 15 seconds and close again in the open space state.

Budiharjo and Milah (2015) in their research entitled Design and Build Room Door Security With RFID And Password Using Arduino Uno. The research designed and realized a tool in a miniature microcontroller-based with the result of a miniature room door that can be controlled based on the ATmega 328 Microcontroller. which works with a power supply that ranges from 5 Vdc and 12 Vdc with RFID results RDM 6300 has a frequency of 125 kHz where after testing it has a maximum distance of reading 7 cm if there is no barrier between the RFID antenna and the Tag Card.

Artificial Intellegence

According to Hendra Jaya (2018: 3) Artificial intelligence (AI) is one of the parts of computer science that makes machines (computers) able to do work as and as well as humans do. At the beginning of its creation, computers only functioned as a calculation tool. However, in line with the development of the times, the role of computers will dominate the life of mankind. Computers are not only used as a calculating tool, more than that, computers are expected to be empowered to do everything that can be done by humans. From the definition above, artificial intelligence (Artificial Intelligence) is a science that studies how to make computers in which there is the knowledge needed to apply them, so that this computer can do the jobs done by humans. According to Hendra Jaya (2018: 5) artificial intelligence has several advantages, including:

1. Artificial intelligence is more permanent, while natural intelligence can undergo changes, this is due to the factors of human nature that are easy to forget.
2. Artificial intelligence is easier to duplicate and deploy.
3. Artificial intelligence is more consistent.
4. Artificial intelligence is cheaper than natural intelligence.

Artificial intelligence applications consist of 2 main must-have parts, namely:

1. Knowledgebase, containing facts, theories, thoughts.
2. Inference Motor (Inference Engine), the ability to draw conclusions based on experience.

Definition of Security System

Security systems are often used to secure valuables and very important data that others should not know. A security system is needed to secure a place that is considered important so that it cannot be stolen. A good security system is a security system that can be monitored anytime, anywhere and can function at any time without gannguan. The security system in this study was used to secure livestock pens using alarms (Farohi, M.I., 2017: 31).

According to Audun J. (2007), security in general can be interpreted as a state of being free from danger. This understanding is very broad and includes a person's sense of protection from crimes both intentional and unintentional such as natural disasters. Meanwhile, a security threat is defined as a situation, condition, or event that has the potential to data or a network, which can be in the form of destruction, leakage, alteration and misuse of data (Farohi, M.I., 2017:32).

Security is a broad topic, one of which includes home security against thieves and intruders. The security system will compare the codes entered by the user with the list or database stored by the security system. If the compared code matches, then the security system will allow access to that user to the services and resources contained in the network or system, according to the level of security owned by that user (Hafiz, 2016:14).

Arduino

Arduino board is a type of electronic board that is currently popular for studying or realizing various electronic projects involving programming. The Arduino family varies widely in size and stability. One of the famous ones is Arduino uno or Genuino Uno. This credit card-sized board is commonly used by beginners to learn microcontroller applications. A microcontroller is a component that contains processesoor and memory and acts like a computer even with limited capabilities when compared to a computer (Kadir, 2019:1). For the physical form of Arduiono Uno can be seen in the picture 2.1

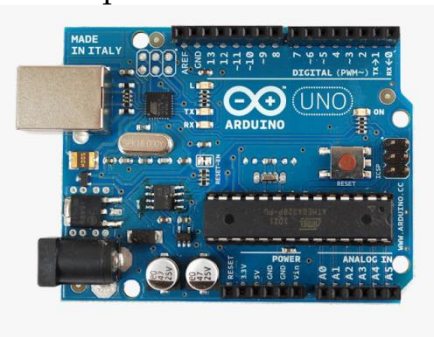

Figure 1. Arduino Uno
Source: Kurnia D, 2017:61

Arduino Uno or ATMega328-based microcontroller board. It has 14 input pins from the digital output, of which 6 input pins can be used as PWM (Pulse Widht Modulation) outputs and 6 analog input pins, 16 MHz crystal oscillators, USB connections, power jacks, ICSP headers, and reset buttons. To support the microcontroller for use, it is enough just to connect the Arduino Uno board to the computer by using a USB cable and AC adapter as a suplay or battery to run it.

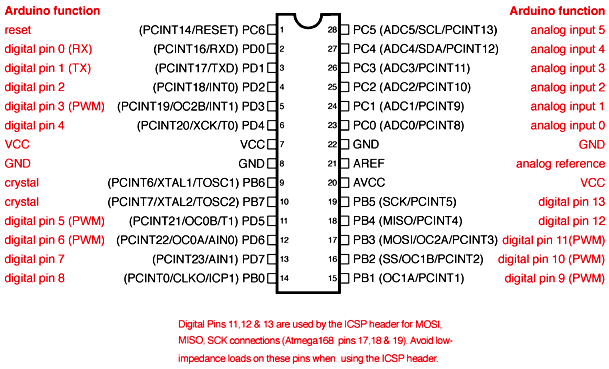

Figure 2. ATMega328 Pin Configuration.
Source: Harjanto and Leonardi (2017).

The advantages of Arduino include that there is no need for a programmer chip device, because in it there is already a bootloader that will handle the upload of programs from a computer, Arduino already has a USB means of communication, so laptop users who do not have a serial port / RS323 can use it. The programming language is relatively easy, because the Arduino software is equipped with a fairly complete set of libraries, and Arduino has a ready-made module (shield) that can be plugged into the Arduino board.

IR Proximity Sensor

Proximity Sensor can be interpreted as a sensor that functions to measure and find out the location of an object that is different in distance. Sensors to find out this distance in their development have two groups, the first is ultrasonic sensors and the second is infrared sensors. Ultrasonic sensors to measure the distance generated from ultrasonic waves emitted or ejected by a transmitter or ultrasonic wave transmitting device. The transmitter emits ultrasonic waves resulting from above-normal frequencies of sound waves. The way it works is actually very simple, at first the transmitter will emit ultrasonic waves which are usually issued periodically in a few seconds once. (Kadir, 2019:229).

An IR Infrared (IR) Proximity Sensor detector or infrared sensor is an electronic component that can identify infrared light (infra red/IR). Infrared sensors or infrared detectors currently exist that are specially made in one module and are named as IR Detector Photomodules. IR Detector Photomodules is a digital infrared detector chip in which there are photodiodes and amplifiers (amplifiers) with outputs in the form of HIGH or LOW conditions. The Shape and Configuration of the PIN IR Detector Photomodules TSOP is:

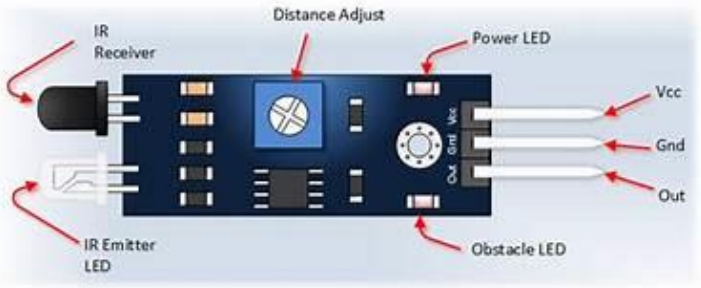

Figure 3. IR Sensor Cross Section

Figure 4. IR Sensor Module Image

The configuration of the infrared pin (IR) receiver or TSOP type infrared receiver is output (Out), Vs (VCC +5 volt DC), and Ground (GND). The TSOP infrared receiver sensor (TEMIC Semiconductors Optoelectronics Photomodules) has key features namely:

1. Using photodiodes as IR Receiver (infrared ray receiver)
2. Using the LM393 Amplifier circuit
3. Low active output,
4. Low power consumption with a fairly long detection range

Infrared detectors or infrared sensors of the TSOP type (TEMIC Semiconductors Optoelectronics photomodules) are infrared receivers that have been equipped with a frequency filter of 30-56 kHz, so that the receiver part or called the IR receiver directly converts these frequencies into logic 0 and 1.

III. RESEARCH METHODS

Data Collection Methods

The data collection method is a method used in a study to solve problems faced in the research process. The data collection method carried out in the study is:

Observation

Observasi merupakan salah satu metode pengumpulan data dengan cara mengamati atau meninjau secara cermat dan langsung di lokasi penelitian untuk knowing the conditions that occur or proving the truth of a research design that is being carried out. Observational activities are carried out to process objects with the intention of feeling and then understanding the knowledge of a phenomenon based on previously known knowledge and ideas, in order to obtain the necessary information and proceed to the investigation process. In general, observation is the activity of knowing something from phenomena. Such activity is based on

knowledge and ideas aimed at obtaining information from the phenomenon under study. The information obtained must be objective, real, and accountable.

Documentation

Documentation is a form of systematic activity or process in searching, using, investigating, collecting, and providing documents to obtain information, information, and evidence and also disseminate it to interested parties. Documentation can also be interpreted as a form of activity or process in providing various documents by utilizing accurate evidence based on records from various sources.

Interview

Interview is an oral question and answer activity between the researcher and the interviewee or person with the aim of obtaining information, data, and information. The form of information obtained can be writing, video, and visual or images. Interviews conducted can be conducted by meeting directly or indirectly. Direct interviews are conducted by meeting directly with people who have the information needed, while indirect interviews are conducted by meeting other people who are seen as being able to provide information about the situation of the person whose data is needed. Interviews were used in research to address the weaknesses of observation methods in data collection. Information from the source can be studied in more depth by providing interpretation of the situations and phenomena that occur.

Literature Studies

Literature study is an activity to collect information that is relevant to the topic or problem that is the object of research. Such information can be obtained from books, scientific works, theses, dissertations, encyclopedias, the Internet and other sources. By conducting a literature study, researchers can utilize all information and thoughts that are relevant to their research. Literature studies are also an important part of research activities because they can provide information about the safety system of livestock pens.

Development Methods

The development method is a systemized or orderly way that aims to analyze the development of a system so that the system can meet the needs. The method used in system development for the design and development of this security system is the prototype method. The Prototype method is a very fast development method and testing new application work models through a process of repetitive interaction so that it can be used properly. The prototype method can solve the problem of misunderstanding between users and analysts, user problems are unable to identify clearly. The purpose of the protorype method is to develop the model into a final system. So this system will be developed quickly and the cost will be lower. A distinctive feature of this prototype method is that system developers, clients, and end users can view and conduct experiments from the very beginning of the development process. The Prototype method is often called the fast application design /RAD because of the simple and fast system design (O'Brien, 2005). The following are some of the stages of the Prototype method:

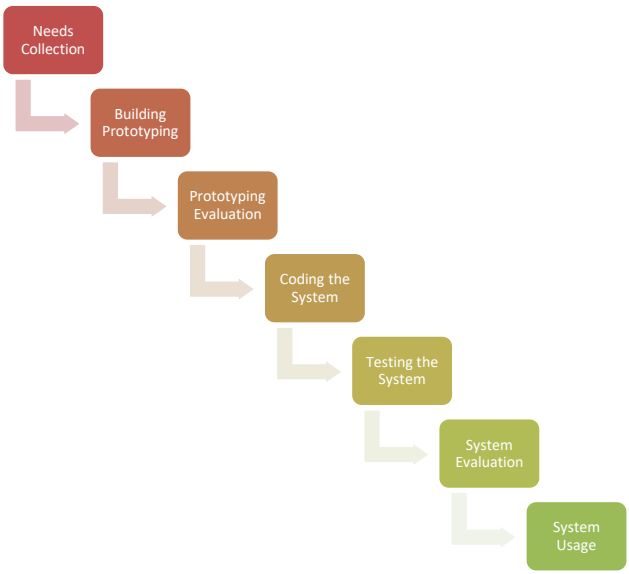

Figure 5. Stages of the Prototype Method

1. Needs Collection
   The first step that must be done in the prototype method stage is to identify all devices and problems. A very important stage of the prototype method is the analysis and identification of the outline needs of the system. After that, it will be known what steps and problems will be made and solved. The collection of needs is very important in this process.
2. Building the Prototype
   The next step is the prototype method step of building a prototype that focuses on customer presentation. Suppose creating inputs and outputs of system results. While only the prototype first, the next aka the tone will not continue to be worked on.
3. Prototype Evaluation
   Before moving on to the next step, it is mandatory to check steps 1 and 2, because it is a determinant of success and a very important process. When steps 1, and 2 are lacking or wrong in the future, it will be very difficult to continue the next step.
4. Coding the System
   Before coding or what we usually call the coding process, we need to know first the coding using programming language. This process is very difficult, because it applies the need in the form of program code.
5. Testing the System
   After coding or coding, of course, it will be tested. There are so many ways to test, for example using a white box or black box. Using a white box means testing the coding while the black box tests the fungus-display function whether it is correct with the application or not.
6. System Evaluation
   Evaluate all the steps that have been done. It is in accordance with the needs or not. If there is no or still revision then it can be repeated and returned in stages 1 and 2.

7. Using the System
   The system is complete and ready to be handed over to the customer, and don't forget to maintain it so that the system is maintained and functions as it should be.

IV. DISCUSSION

Software Design

Here's a block of software design diagrams.

Figure 6. Software Design Block Flow Image

In this design, commuters are used to create programs that will be input into the microcontroller. The program is created using an Arduino IDE application with a programming language using the C language. The next step is to insert the program using a USB data cable into the microcontroller.

Program Design

Here is the design of the program using the Arduino IDE application:

1. Open the Arduino IDE program so that it looks like an image.

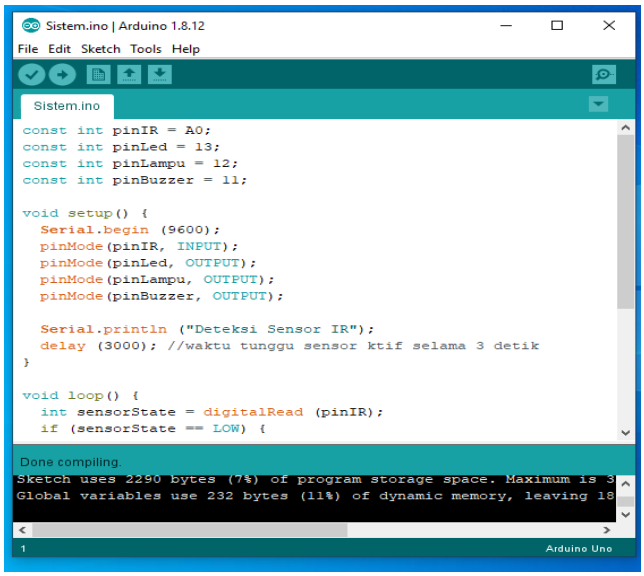

Figure 7. Arduino IDE display

2. After the program has been created, the next step is to save the program which will be converted into a file with the extension .ino by means of

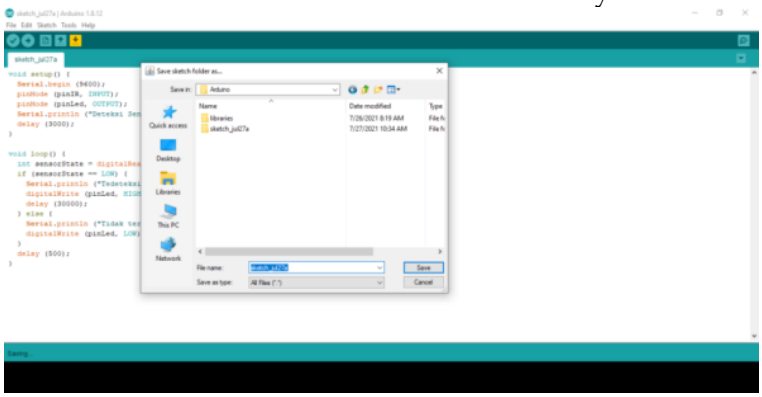

Figure 8. Save File view

3. Compile the program to check whether there are errors or not by clicking Sketch then select Verify / Compile or press Ctrl + R.

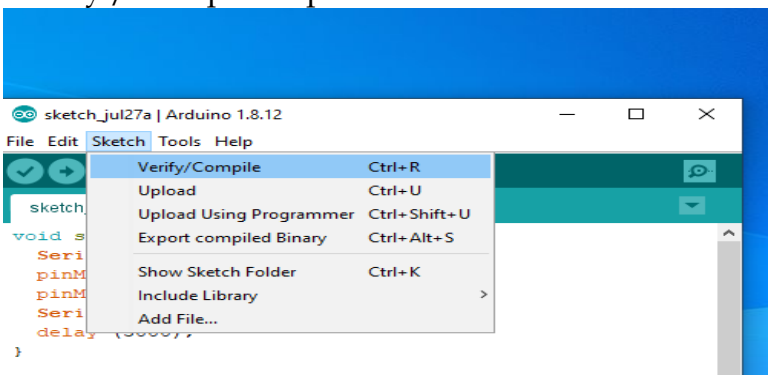

Figure 9. Compile Program View

Testing Tools

This security system is used to notify the owner of the cattle shed that there is a danger approaching so that the cage owner can do something and the danger stays away. The system consists of an Arduno circuit, IR Sensor, Buzzer and Light that will light up when the buzzer sounds. To control that the designed tool works as expected for it is carried out hardware testing as well as software.

Tool Assembly

Module assembly is carried out by connecting the Arduino Uno module, IR proximity sensor, and Buzzer. The assembly of the tool is shown by figure 4.15.

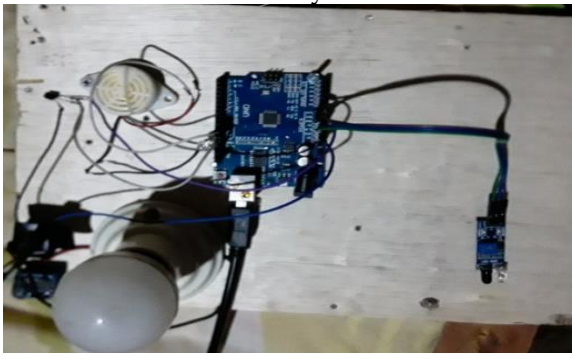

Figure 10. Tool Assembly

The next step is to program the tool on the Arduino uno as the brain of the safety device. Programming and uploading hex code to the Arduino Uno module using the Arduino IDE application.

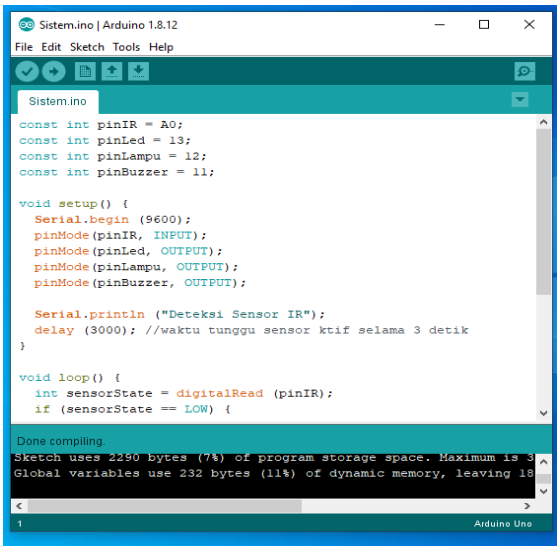

Figure 11. Arduino Programming

Software Testing

This program is carried out by means of a microcontroller performing the initialization process first according to the type of microcontroller used in this program using the Arduino Uno microcontroller. After the initialization process is successful, the next step is the process of initializing the connection between the microcontroller and the rest of the system circuit. The system connection is in the Arduino program application and it also requires the port settings of the minimum system connected to the laptop / computer, by selecting Com 11 is used as an interface to the tool, and the baud rate is 9600. As figured 4.18 below looks like.

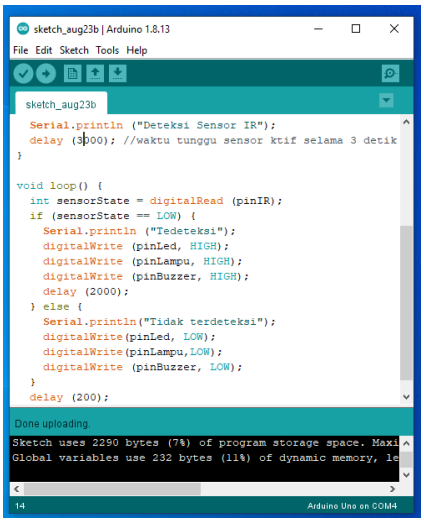

Figure 12. Arduino Programming

The software used in this system is to use the Arduino IDE with the C language. After the program is designed, the program is then uploaded to the microcontroller directly through a PC or laptop to save the program to the Arduino chip.

To test a program that has been designed successfully and as we want, the program before compiling whether an error or error occurs. Then the sketch is uploaded to be saved to the Arduino chip. After that we try to bring our hands or an object close to the sensor then the buzzer will sound and the lights turn on as a sign that there is a danger approaching.

Buzzer Testing

Testing the Buzzer module is carried out by applying a voltage of +5 VDC at the input, then the buzzer will sound. After that at the input of this module a voltage of 0 VDC is given, then the buzzer will not sound. The voltage of +5 VDC represents logic 1 while 0 VDC represents logic 0. Overall testing is carried out to see if the system created by combining all components into one unified system can work properly and as expected. Testing is carried out by installing all components into a Livestock Cage Security System Tool where the transmitter and receiver are activated.

Analysis of Results

After everything is done and tested one by one, then combine all the circuits or systems made both software and hardware, so that it becomes a livestock cage security tool using Arduino Uno. After that, the tool testing is carried out so that the tool can run as desired to detect passers-by in the livestock pen for which we have installed a room or house security device. Here's the image below of the overall tool image.

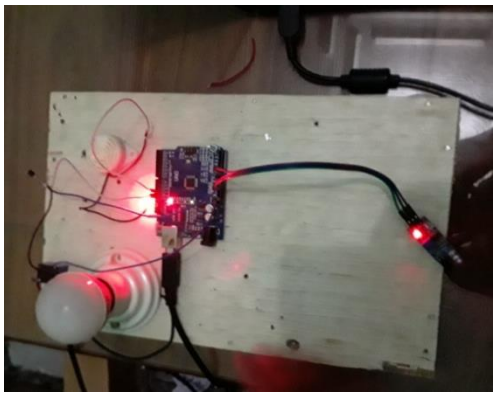

Figure 13. Overall Circuit View

V. CONCLUSION

Based on the analysis and discussion of existing problems, it can be concluded that the design of the tool with this security system can provide information to livestock shed owners that there are thieves approaching. The design of tools with this security system can be used to maintain the safety of livestock pens from theft.

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