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Home Anti Theft System Uses Based Telegram Bot Internet of Things

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A B S T R A C T

The rapid development of Internet of Things (IoT) technology has enabled the creation of innovative solutions in the field of home security. This research proposes the design and implementation of a Home Anti-Theft System that integrates IoT devices with a Telegram Bot as a real-time communication platform. The system employs various sensors, such as motion detectors and door sensors, to monitor home security conditions. When suspicious activity is detected, the data is processed by a microcontroller and immediately transmitted to the homeowner through a Telegram Bot notification. This allows users to receive alerts, monitor security status, and control the system remotely via their smartphones. The results of system testing demonstrate that the proposed solution is effective in providing real-time alerts, easy to operate, and cost-efficient compared to conventional security systems. Thus, the integration of IoT and Telegram Bot in a home anti-theft system offers a practical, accessible, and reliable security solution for modern households.

INTRODUCTION

Along with the development of technology, it has now become a human need in carrying out daily activities. Starting from doing work, education, business, entertainment, social, household needs and so on. Latest technology allows several devices or gadgets to be used, such as computers, laptops, tablets, cameras and cellphones [1,2,3]. The use of technology for humans also helps complete work that is a human obligation in life. This technological development must be followed by developments in Human Resources (HR). The extent of technology has influenced various aspects of modern life, of course technology continues to develop rapidly, bringing changes and new opportunities in various fields.

We often hear of cases of home theft and valuables being stolen. This criminal act is difficult for the owner of valuables to detect. Usually this will be discovered after the theft has occurred. Situations like this certainly make us uncomfortable and feel anxious about our valuables. There were 2,760 criminal crimes recorded in January – June 2023 in the city of Medan, North Sumatra [4,5].

With the rise of crime in the city of Medan, it certainly makes the owners of houses and valuables feel uncomfortable, usually the owners of houses or valuables use CCTV (Closed Circuit TeleVision) to find out what their surroundings are like. However, the use of CCTV has a weakness, namely, crimes can only be revealed when we look at CCTV footage, this of course still makes it difficult for us to solve this problem.

In this modern era, we discover many new technologies such as the Internet of Things or IoT. The Internet of Things is a device that is connected via an internet network. IoT is equipped with sensors, software and communication technology that allows us to interact with each other and transfer data. These sensors can detect information about the surrounding

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environment such as temperature, humidity, movement and location. The collected data can then be processed and decisions taken or can be accessed in real-time via the internet.

Based on the problems above, researchers want to create and develop a system that has previously been implemented. Here researchers created a Home Anti-Theft System Using Internet of Things-based Telegram Bots. This can minimize inconvenience for home owners or owners of valuables when they want to travel long distances for a short period of time. This research will use the ESP-32CAM as a WiFi camera module, an ultrasonic sensor as a movement detector, and the Telegram application as a notification. This sensor is placed close to the main door of the house, so the sensor will work when there is someone suspicious in front of the house.

METHOD

The research method used in this research is the Prototyping method. The prototyping method is a software development process that begins with collecting system requirements, which is followed by making a prototype and evaluating users [6,7]. By using a prototype, researchers have an idea of the system that will later be built or developed

Research Stage

Research is an activity that requires quite a long time, so it needs to be planned well. Good research always begins with good planning. As the wise saying goes, "When we don't make a plan, it's like we're planning for failure." The research carried out by the researcher began with a literature study and ended with the system testing stage. At this research stage there are several stages of research or research design which are systematic steps in conducting research.

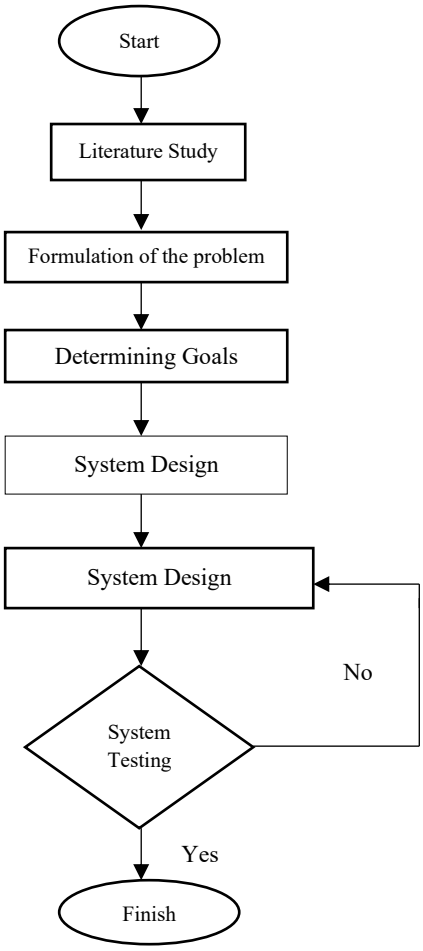

Figure 1. Research Stage

The following is an explanation of the research stages in the picture above.

1. Literature Study

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Researchers carry out literature studies by collecting and understanding theoretical references originating from theoretical books, research journals, and other authentic library sources related to the research topic, namely home anti-theft systems, Smarthome, ESP-32CAM, 1 Channel Relay, Selenoid Door Lock, Ultrasonic sensor, Telegram and Arduino IDE.

2. Problem Formulation
   At this stage the researcher formulates the problem which is the reason this research was conducted. The aim of formulating this problem is for researchers to know the specific problem so that it can be easier and more focused to solve the problem through research.
3. Determine goals
   Researchers determined the aim of the research, namely to create a control device capable of replacing CCTV and house door locks that can be monitored remotely with the Telegram application which is accessed via smartphone using an internet connection.
4. System Design
   System This stage is the design stage of the system design or model of the tool to be made. System design consists of a system block diagram and an overview of the system as a whole.
5. System Design
   At this stage the researcher carries out product design consisting of hardware design and software design. Hardware design consists of mechanical design and electrical design. Meanwhile, software design consists of bot design on the Telegram application, and program design on the ESP-32CAM via the Arduino IDE.
6. System Testing
   Product testing is carried out to determine the level of success of the tools that have been made. At this stage there are two types of testing, namely hardware testing and software testing.

Equipment Used

In designing this system, several tools, materials and supporting application programs are needed, which are grouped into 3 parts, namely hardware, software and supporting tools. The hardware used includes a laptop, smartphone, ESP-32CAM module, 1 channel relay, Selenoid Door Lock, Buzzer, Ultrasonic sensor, and Telegram. The software used includes the Windows 11 operating system, Arduino IDE 1.8.19, and the Telegram application. Meanwhile, the supporting tools used in building this tool include electric soldering iron, tin, multimeter (measuring instrument), cutting pliers, and screwdrivers.

System Design

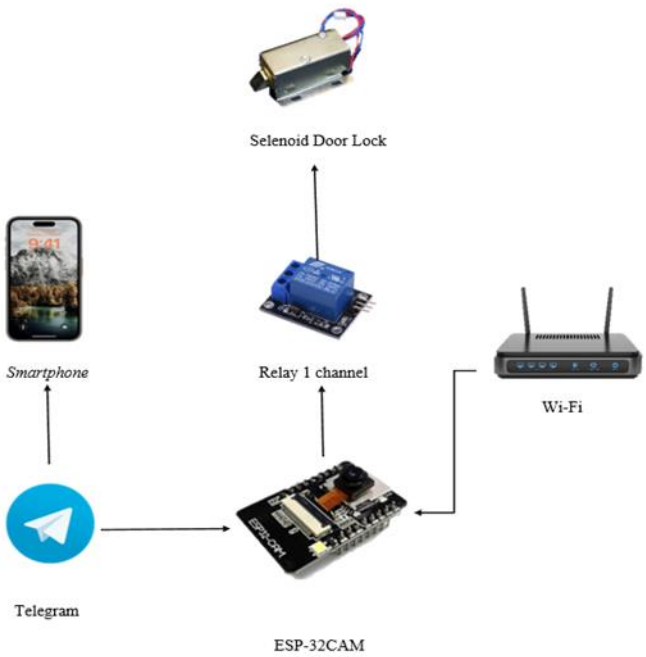

Figure 2. System Design

Network Design

Designing circuits that have certain functions and are interconnected helps the system. The circuit tools in this research are controlled with NodeMCU ESP-8266, ESP-32CAM and 1 Channel Relay. More details will be discussed at the next stage.

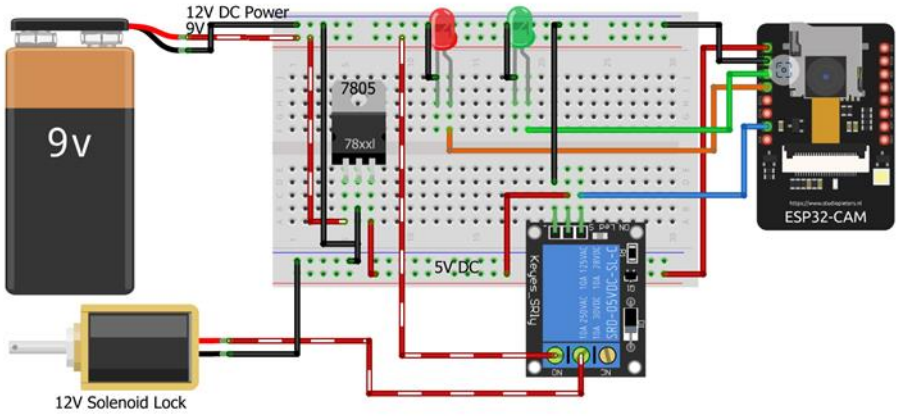

Figure 3. ESP-32CAM Circuit and 1 Channel Relay

Software Configuration

This software design uses the Arduino IDE which will show how the tool system that has been created works. The flow of this research program is to start the program by creating source code in the Arduino IDE then connecting it to the Telegram application. Then a notification is entered into the Telegram application if someone is standing in front of the ESP-32CAM camera sensor or approaches the ultrasonic sensor and then presses the start button on the Telegram application chat bot. Next, there are several options, namely by typing lock or locking the door, unlock or opening and to retake the photo by typing photo into the Telegram application chat bot. When typing commands directly or via the inline keyboard, typing can be done directly in the initial start instructions. After that, to unlock the door we can type on the inline keyboard, for example: /unlock, then the Telegram application chat bot will send the message "/unlock" to the ESP-32CAM. If input is received by the ESP-32CAM then the door will open. Likewise, if you type "/lock" the door lock solenoid will receive a message from the ESP-32CAM to lock the door. If the photo captured by the ESP-32CAM camera is not clear, we can type "/photo".

Telegram Bot Configuration

In this Home Anti-Theft System, we send Telegram commands via a pre-configured Bot. To configure this Telegram application bot, we must have the Telegram application and make sure you have registered, so you can configure this Telegram bot. Then enter the "Telegram Messenger" application and search for Bots with the keyword "BotFather". We can see the BotFather appearance in the Telegram application in Figure 4.

Figure 4. Bot Father

Bot Father is a bot whose function is to configure bots and manage bots that have been previously created. Bot Father has many functions, namely creating bots, deleting bots, changing bot names, changing bot descriptions and other things related to bots. To create this bot we need to type the command "/newbot", then we will be asked for the name of the bot that we will use, for example, we write "System_Anti_theft_Bot", then we will be asked to write the username that will be used for the bot, for example we write username "Anti_theft_Bot_System". After writing and determining the username of the bot, we will be given a Token from the bot. This token has a very important function and other people are not allowed to know about it. The token here functions to access the HTTP "Hyper Text Transfer Protocol" and the bot's "Application Programming Interface" API. Then when the bot is ready, we will enter the bot "System_Anti_theft_Bot" then write "/start" then there will be several options for carrying out actions to open the door "/unlock", "/lock", and "/photo". That way we can control the Solenoid Door Lock using the telegram bot that has been successfully created.

RESULTS AND DISCUSSION

This chapter explains the research results and discussion of a home anti-theft system using an internet of things-based telegram bot. This system was designed using the prototype method. There are also results of the design of this system as follows.

Tool Design Results

The home anti-theft system prototype uses an internet of things-based telegram bot with an ESP32-CAM microcontroller. This circuit is connected using jumper cables and adapters as a current connector. This circuit will be connected to the Telegram application via the internet network.

Figure 5. Tool Prototype

System Testing Results

There are several options for running the system that has been designed. The following is a display of the telegram bot system as a medium for monitoring and remote control of this home anti-theft system that has been designed.

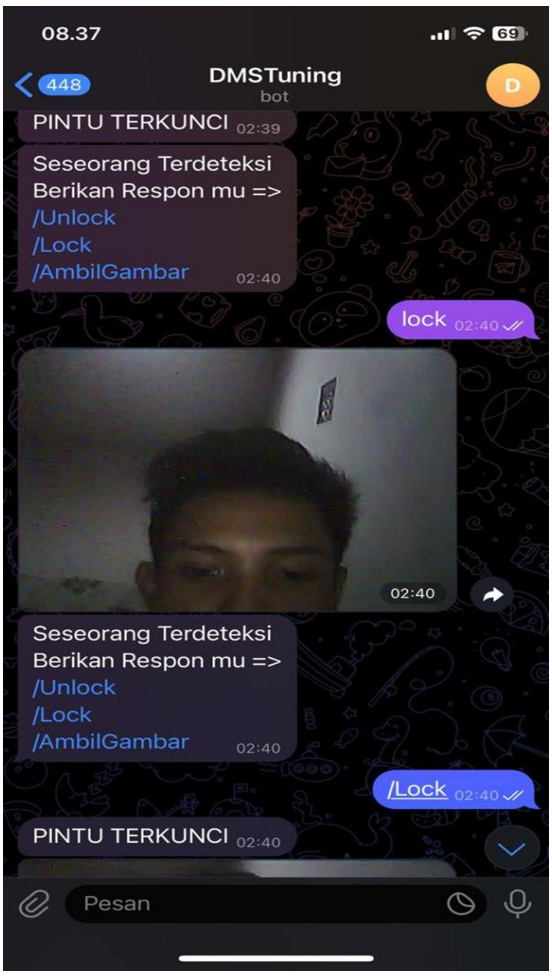

Figure 6. Show Telegram Photo 1

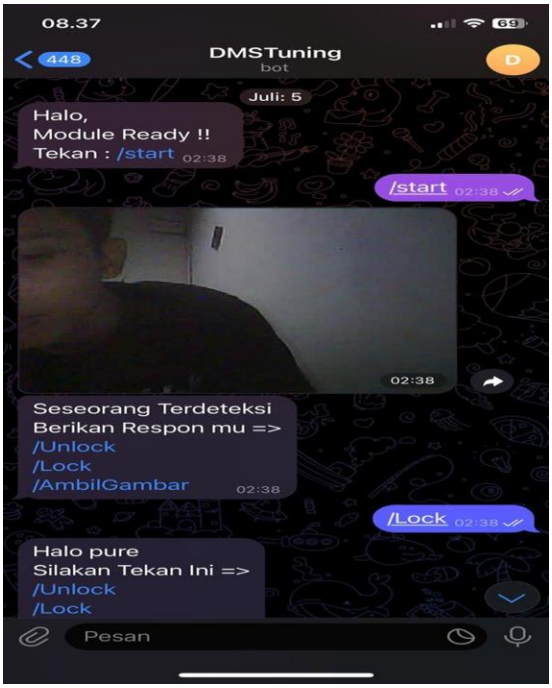

Figure 7. Show Telegram Photo 2

In this Telegram application, monitoring can be carried out on the home anti-theft system that has been designed. In this Telegram application bot, users can control the door of their house directly and monitor their surroundings.

Prototype Testing Results

At the results stage, tools and systems are tested to determine the function and purpose of this system so that it meets expectations. In testing tools and systems, testing is carried out which focuses on the function, appearance, use of tools and systems.

In testing this tool, it can be seen that all tools can work according to their function. Apart from testing the tool, testing of this anti-theft system can be seen in the following table:

Table 1. System Testing

Order	Information	Results
1. Detect movement	A person approaches the HC-SR04 ultrasonic sensor	The ultrasonic sensor detects if someone is right in front of it and the ESP32-CAM will take a photo which is sent to the Telegram application.
2. Take a photo	Type "/photo" in the Telegram application bot	ESP-32CAM will retake photos and send them to the Telegram application
3. Open the door	Type "/unlock" in the Telegram application bot	The mainboard will send a command to the door lock solenoid and the door lock will be opened
4. Lock the door	Type "/lock" in the Telegram application bot	The mainboard will send a command to the door lock solenoid and the door lock will be closed

After testing this system, the results obtained are:

1. When the user approaches the ultrasonic sensor, the buzzer will sound and send a notification via telegram, then the ESP-32cam will take a picture. When the user does not know or know someone who is right in front of the system, the telegram bot will send a command to the door lock solenoid to lock the house door or open the house door.
2. When the user is at a long distance, with this anti-theft system device the user can find out developments around the house where this anti-theft system is placed and can provide a quick reaction to this device which will then send notifications to the Telegram application.

CONCLUSION

The development of a Home Anti-Theft System using the Internet of Things (IoT) integrated with a Telegram Bot has proven to be an effective and efficient approach to improving household security. By utilizing sensors to detect unauthorized access and sending real-time notifications through Telegram, the system enables homeowners to monitor and respond to security threats quickly and conveniently from their smartphones. The implementation results show that the system is reliable, user-friendly, and cost-efficient compared to traditional security systems. Furthermore, the integration of IoT with a widely used communication platform such as Telegram enhances accessibility and practicality for daily use. Overall, this study demonstrates that IoT-based security solutions offer significant potential for modern households and can be further developed by integrating additional features such as video surveillance, cloud storage, and advanced authentication methods to enhance security and scalability in the future.

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