


Machine to Machine Automatic Housing Area Security System Prototype Using MQTT IoT Communication Protocol

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Abstract: Environmental security is a shared responsibility between the community and officers who are specifically authorized to maintain the security of an area. For this reason, the role of the community in informing actions that interfere with safety is important. This study aims to create a prototype of an environmental security system using an emergency button application for security to inform certain security conditions. This research was developed using the Research and Development model approach by conducting a needs analysis, then it was designed and implemented in the form of hardware which was then tested for its functionality. Functions offered in this model include emergency hazard buttons, stranger alert, out-of-town, and assistance. The system is connected to each guard post in the housing. The prototype has been tested for functionality and works well according to its function.

1 INTRODUCTION

The comfort of the living environment is one of the basic needs in social life. This is based on a finding that environmental comfort is the dominant factor in choosing a place to live (A. Syafrina, 2018). Housing developers have a challenge so that the housing environment is designed in such a way that it meets the environmental comfort requirements as regulated by the government. Public and social facilities are needed by the community in a residential area (Nuryasin, 2021). Some of them, are security facilities, worship, health, education, and others. However, some housing estates do not yet have complete supporting facilities. One of them is a one-gate system. The problem due to the non-enforcement of the one-gate system is that it opens up opportunities for crime to enter from unofficial doors. Several cases of crime occur in housing, such as theft, in addition, some criminals are good at disguises so they are not recog-

nized when they act (Okezone, 2020). Crimes also occur by individuals who disguise themselves as scavengers and buskers (Liputan6, 2017). Based on the above background the author intends to develop a prototype emergency button on a housing. The prototype was developed based on a website that is connected to the security guard post. Several researchers have researched similar topics. These studies have their characteristics, such as an emergency button to maintain campus security (A. Wijayanto, 2019). This study aims to respond to security disturbances in the campus environment. Another study resulted in the application of emergency buttons in hospitals. This study aims to make it easier to make emergency calls to the hospital for emergency cases (M. Anike, 2019). Meanwhile, several other studies have also produced similar systems such as emergency button applications implemented by the police (M. Afdal, 2020) and the development of emergency button applications installed in crowded places that are integrated at the central security post (A. I. Afolabi, 2018). In this

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study, the authors focus on making a prototype of an emergency button on housing by integrating it at a security post using the MQTT Protocol whose output can be displayed via DMD P10 at each related security post, besides that this prototype is accompanied by an alarm notification if there is an emergency message from residents. The prototype offers emergency button functions for alerts, stranger alerts, out-of-town notifications, and requests for assistance to health workers.

Several researchers have produced similar systems such as applications for emergency buttons on housing and campus security systems that are integrated with the main security post through the integration using the HTTP protocol. However, this is not efficient because it requires a good and stable connection. Besides that, it takes a long process of sending messages from the incident location to the security post. When compared with previous research, there are several advantages of the tools that we developed, namely the system tools are easy to install, maintain, and operate. Other than that, it is also cheaper in terms of the total cost of these tools namely installation and maintenance costs. This means it is more efficient than the previously researched applications. There are also additional benefits, that this tool is also more effective than the one using the HTTP protocol. Because it is using the widely used lightweight communications MQTT protocol that doesn't require a good and stable connection. The operation of this tool is easy, it only needs to press the emergency button, and the tool will directly send a message to all security guards in the area.

1.1 Housing Area

Housing is a building where humans live and carry out their lives, besides that a house is also a place where the socialization process takes place in which an individual is introduced to the norms and customs that apply in a society. As a place for human life, it is not only about technical and physical aspects but also social, economic, and cultural aspects of its inhabitants. (Budiharjo, 1998).

1.2 MQTT

The MQTT protocol is one of the IoT's application protocols. This is the most widely adopted protocol for developing IoT applications compared with the other application protocols (N. Naik, 2017). MQTT was developed by Andy Stanford-Clark of IBM (U. Hunkeler, 2008) and Arlen Nipper of Arcom in 1999 and standardized in 2013 by the Organization for the

advancement of structured information standards (OASIS) (A. Banks, 2014). It's suitable for IoT applications due to its simple model and low bandwidth usage. Furthermore, it guarantees the reliability of packet delivery. Some features of the MQTT protocol: It's a published/subscribe protocol and runs over TCP/IP. It's suitable for constrained environments due to its simplicity and open source code. It also supports three levels of quality of service (QoS).

In MQTT, the publish-subscribe model mentioned below in Figure 1, the publisher sends the data to the broker for publishing in the 'Publish' message; a subscriber authenticates and subscribes to the broker for a certain topic on the 'Subscribe' message, and the broker sends the data to the specific subscribers that are subscribed to the specific topic on 'Publish' message.

1.3 Emergency Button

The emergency button device is a manual control device. It is the method of initiating the emergency function. An Emergency button is an electronic device designed to assist in alerting somebody in emergencies where a threat to persons or property exists. These buttons can be connected to a monitoring center or locally via a silent alarm or an audible bell/siren. The alarm can be used to request emergency assistance from local security, police, or emergency services.

1.4 Security

From such a perspective, the general definition of security is usually thought to be encountered in the absence – or at least unlikeliness – of threats to a certain object. For example, David Baldwin has defined security astutely as a low probability of damage to acquired (Baldwin, 1997). Similarly, for Lawrence Krause and Joseph Nye, it was the absence of acute threats to the minimally acceptable levels of the basic values that a people consider essential to its survival (Krause, 1975).

1.5 DMD P10

Dot Matrix Display P10 Running text or also known as writing walking is one of the electronic media which is very useful for conveying messages and information that can also be used as advertising means. In its development, displaying running text is now present not only in showing a series of running texts but also for display images or logos (Simanjuntak, 2019).

2 METHOD

In the process of making a prototype, it is necessary to design and flow to be able to know the development and progress of the prototype as follows.

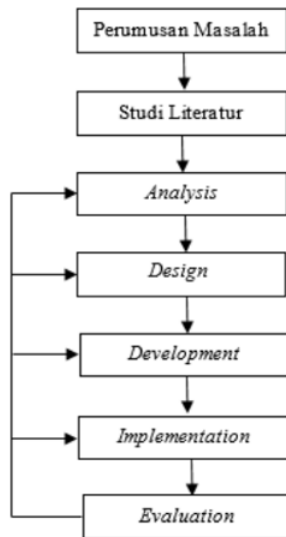


Figure 1: Prototype flow drawing.

The formulation of the problem is obtained based on real events that often occur in the community, especially in the housing complex area.

Literature studies on research take sources from various journals and the internet about wireless home security, MQTT protocol, IO platform, Internet of Things, DMD P10, and microcontroller (Imam Sutrisno et.al., 2014).

2.1 Analysis

a. Functional Needs Analysis

1. Designing a P10 control system circuit using MQTT.
2. Designing a data transmission system using MQTT
3. Design a series of tools to support the DMD P10. control system

b. Non-Functional Needs Analysis

1. Hardware (Hardware)
 - Computer/Laptop
 - DMD P10. control circuit board
 - Jumper Cable
 - USB cable
 - DC5V adapter
2. Software
 - MQTT Explorer app
 - Platform IO

- Visual Studio Code
- Eagle
- Fritzing App

2.2 Design

a. Hardware Design

The hardware design is carried out for the ESP 12-e IC as well as other modules and devices.

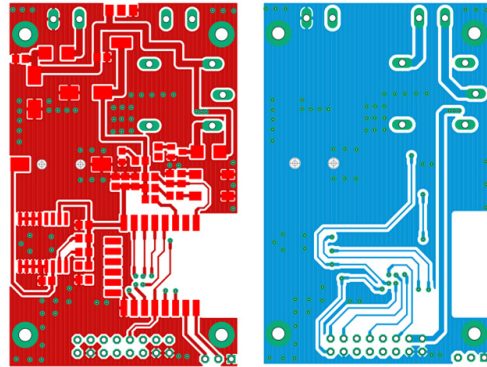


Figure 2: Custom PCB Design.

b. Software Design

In the software design, the process of making a program on the IO platform is carried out for sending data from the MQTT explorer to DMDP10 (Sutrisno, 2012).

2.3 Development

Hardware and Software development is carried out as follows.

- Define components
- Designing the board on the eagle, printing the board, assembling the board to DMDP10, checking the board and wiring board
- Upload programs and define efficient algorithms
- Test the tool to make sure the tool works well

2.4 Implementation

At this stage, testing the tool and checking the data transmission via MQTT explorer to the board and displaying the results on DMDP10 (Jami'in M.A.,2014).

2.5 Evaluation

Evaluation is the stage where the author sees the level of success of the tool after passing the trial and is used as input for the next stage of development (Sutrisno, 2014).

create an ideal social environment by minimizing criminal acts that occur. Prevention and handling of criminal acts can also be done more precisely and quickly than before. This prototype system has many development possibilities. It is hoped that in the future this system can be developed further. Starting from input devices that can be upgraded with various sensor modules such as cameras, infrared, and LiDAR, Main Processing Units that can be programmed with Machine Learning-based Artificial Intelligence that can be trained to recognize suspicious objects, and Output Devices that can be added with motors that can controlling instrumentation that can block the way in and out of residential areas.

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