Design and Implementation of Doorcam in Home System using Raspberry Pi

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Abstract. This paper discusses how to develop a doorcam system that is implemented at home at an affordable price. The system was built using a Mini PC Raspberry Pi, and a Pi camera to obtain an affordable price for the doorcam system implementation. The results of tests that have been carried out were the system had succeeded in notifying the homeowner when there were guests who were visiting the house. The system will send a notification message and display the image captured by Pi camera via the Telegram application when the guest press bell button. The system worked with delay below 5 seconds. This system can work well when done during the daytime, because the Pi camera used is not equipped with lights, so the captured images that are sent cannot show guests coming to visit in front of the house.

1. Introduction

Internet of Things (IoT) can be described as connecting devices used daily such as computers in the form of PCs, laptops, tablets, smart phones, televisions, sensors and actuators to the Internet where devices are connected intelligently forming communication between things and humans [1]. The current implementation of IoT such as smart home has been widely implemented. The development of this technology is to add a doorcam system feature that can make it easier for homeowners to know guests who visit their homes, both when they are at home or outside. But not everyone uses this feature because the price of the system is not affordable [2].

Mini PC such as Raspberry Pi in designing a doorcam system to produce a systems for an affordable price can be a solution. The selection of Raspberry Pi is due to its cheap price, low power consumption, and the availability of open source software in developing applications [3][4]. The advantage of Raspberry Pi is that this small computer has been widely implemented in the development of IoT technology, because apart from its reliable device and has a discussion community that is easily found on the Internet [5].

The purpose of designing and implementing this system is to produce a doorcam system at an affordable price that can be utilized in all homes and homeowners can have a safe comfort in their house because they know guests who come to their homes before answering and opening their doors.

2. Method

Smart system and IoT are driven by combination of three things: sensors and/or actuators, connectivity and people/process. The components as illustrated in the Figure 1.
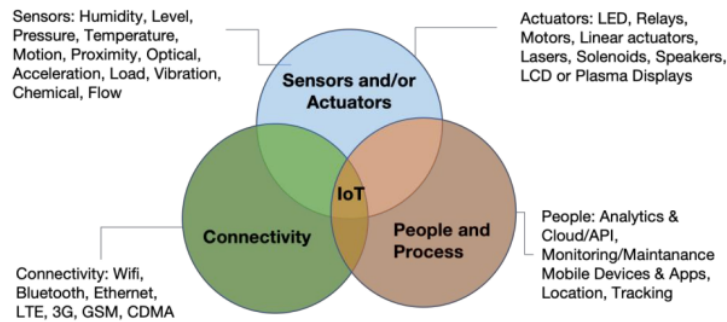
Figure 1. IoT Component

The components explanation:

- Sensors: The object is able to extract various data from its environment such as humidity, level, pressure, temperature, motion, proximitym optical, acceleration, load, vibration, chemical, flow [6].
- Actuators: The object is able to act within its environment: emit light, make sound, push button, etc.
- Connectivity: The embedded system can use a range of connectivity to connect with other devices or the Internet. Some of example are such as wifi, Bluetooth, Ethernet, LTE, 3G, GSM, CDMA, etc[7].
- People and process: The information transmitted via the chosen connectivity can be used by people and processes to take action.

3. Results and Discussion

Figure 2 depicted the illustration of doorcam system. The doorcam system working with the following steps: when guests arrive and visite the house, they will press the bell button on the Raspi LCD display where it is usually put near to the door or gate. Then, system will start taking pictures using Pi's camera and then the system will send picture and text messages to the homeowner through Telegram application that has been installed on the homeowner's smartphone. From the Telegram application, the homeowner can send a message back whether he wants to meet immediately or not. The reply message will appear on the LCD screen that can be seen by the guest.

Homeowners can find out who is coming to their house whether they are inside or outside the house. Guests can also leave voice messages recorded by the system, and the message is sent via the telegram application.

IoT components used in this system are actuators in the form of LCD screens, connections using wifi technology, and people who use this system are guests and homeowners using their smartphones to be able communicate with the system. Hardware specification for this system described on Table 1.
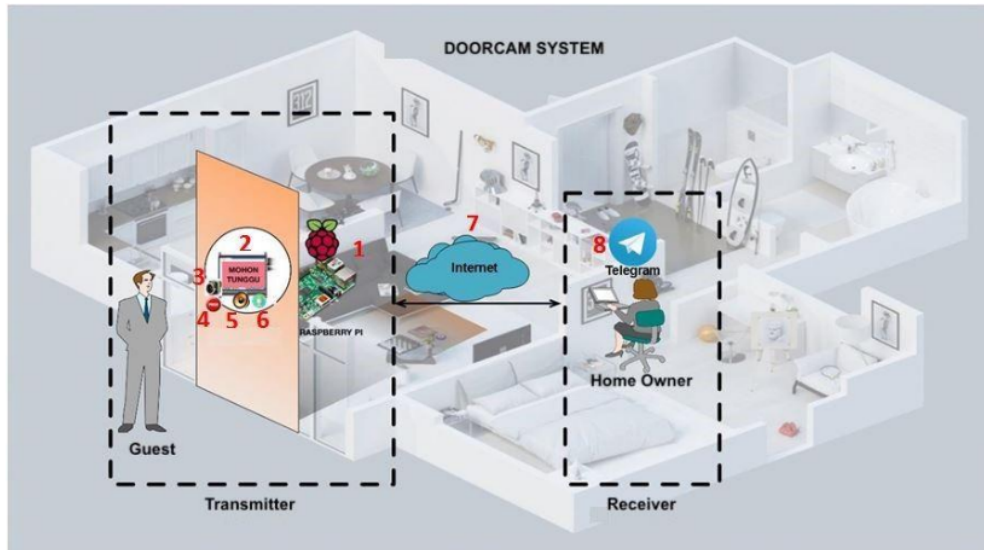
Figure 2. Doorcam System Illustration

Table 1. Hardware Specification

Item	Specification
Mini PC	Raspberry Pi 3 Model B+
Camera	Pi Camera
Display	Raspberry Pi LCD

Figure 3 depicted the interface on LCD monitor telling guest to push the button to inform the homeowner. While the guest waits in front of the door, the system sends message to homeowner. Figure 4 displays the message from homeowner. If the homeowner is not at home, the system will enable the button "Kirim Pesan Suara", so the guest can start to record voice message for 7 seconds, and then the system sends the message through Telegram application. Figure 5 depicts notifications on Telegram application.

The test result shows the average delay of this system is below 5 seconds. This total delay counts from the system received instruction to captured image untill the message arrived on smartphone. This system will be able to produce maximum output if this system is used before sunset, where there is still good lighting. This is because the desired system is that the system can transmit data with a minimum delay, so a small pixel camera is chosen but is still good enough to display recognizable faces. the drawback is that when this system is used at night, the image sent will be a black image because when it does not get good lighting.

We can use a better camera than a Pi camera with a more expensive price. This can be adjusted to the existing budget conditions. If it is compared to the doorcam on the market, it usually costs more than IDR 2,000,000 with a camera that is equipped with night vision, while this system can cost only under IDR 1,000,000.

Figure 3. The Interface on LCD Monitor Telling Guest to Push the Button to Inform the Homeowner.

Figure 4. System Display the Message from Homeowner

Figure 5. Notification on Telegram Application

4. Conclussion

From the test result that has been done, the doorcam system that was designed has succeeded in notifying the home owner when there are guests who are visiting. The drawbacks of this system images has noise due to the lighting factor when taking pictures, especially at night. Moreover, the system still suffer from delay below 5 seconds. Future work is to replace the camera that has infrared, and reducing the complexity of algorithm so that the system can work faster and efficient.

Acknowledgment

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