

# APPARATUS AND SOFTWARE APPLICATION FOR MAILBOX NOTIFICATION

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## References Cited

### U.S. PATENT DOCUMENTS

6,046,675	4/2000	Hanna
6,462,659 B1	10/2002	Schuette
6,831,558 B1	12/2004	Andrew
6,995,671 B2	2/2006	Dutta et al.
7,025,249 B1	4/2006	Ledbetter
7,225,971 B1	8/2006	Cherry
7,843,340 B2	11/2010	Davis

### OTHER PUBLICATIONS

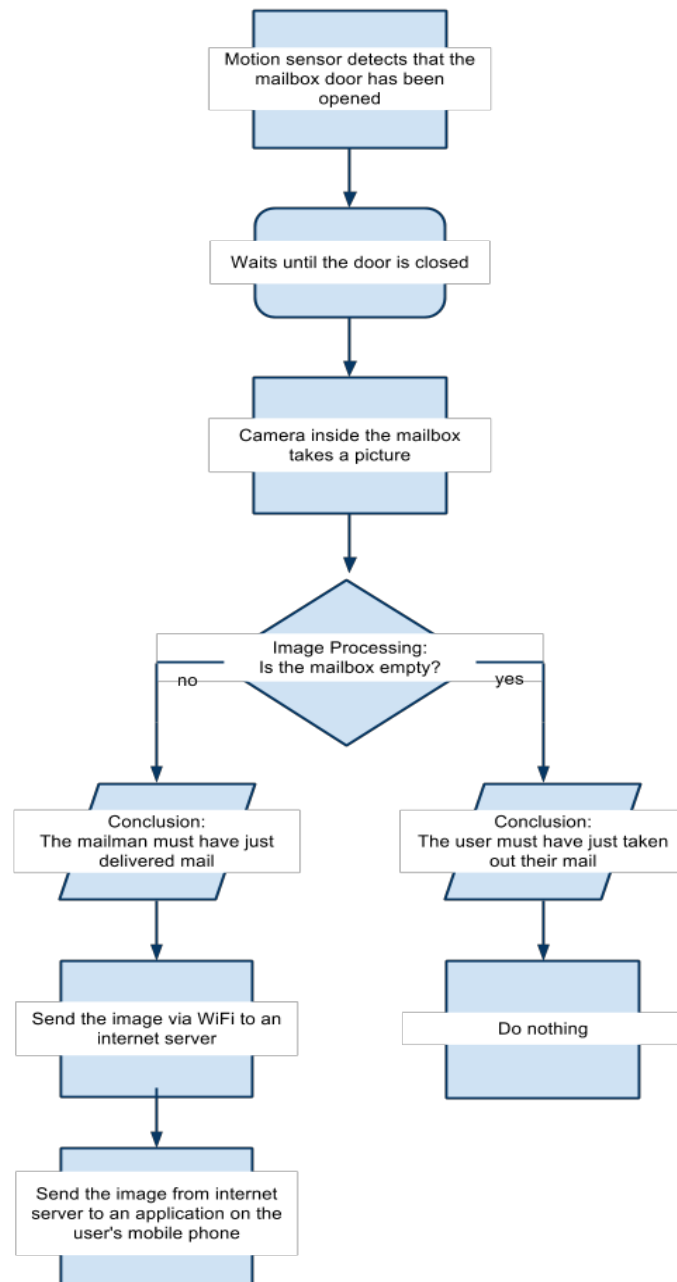
Gordon, Whitson. "DIY Snail Mail Notifier for Your Smartphone." *Lifehacker.com*. Gawker Media, 3 Jan. 2011.

## ABSTRACT

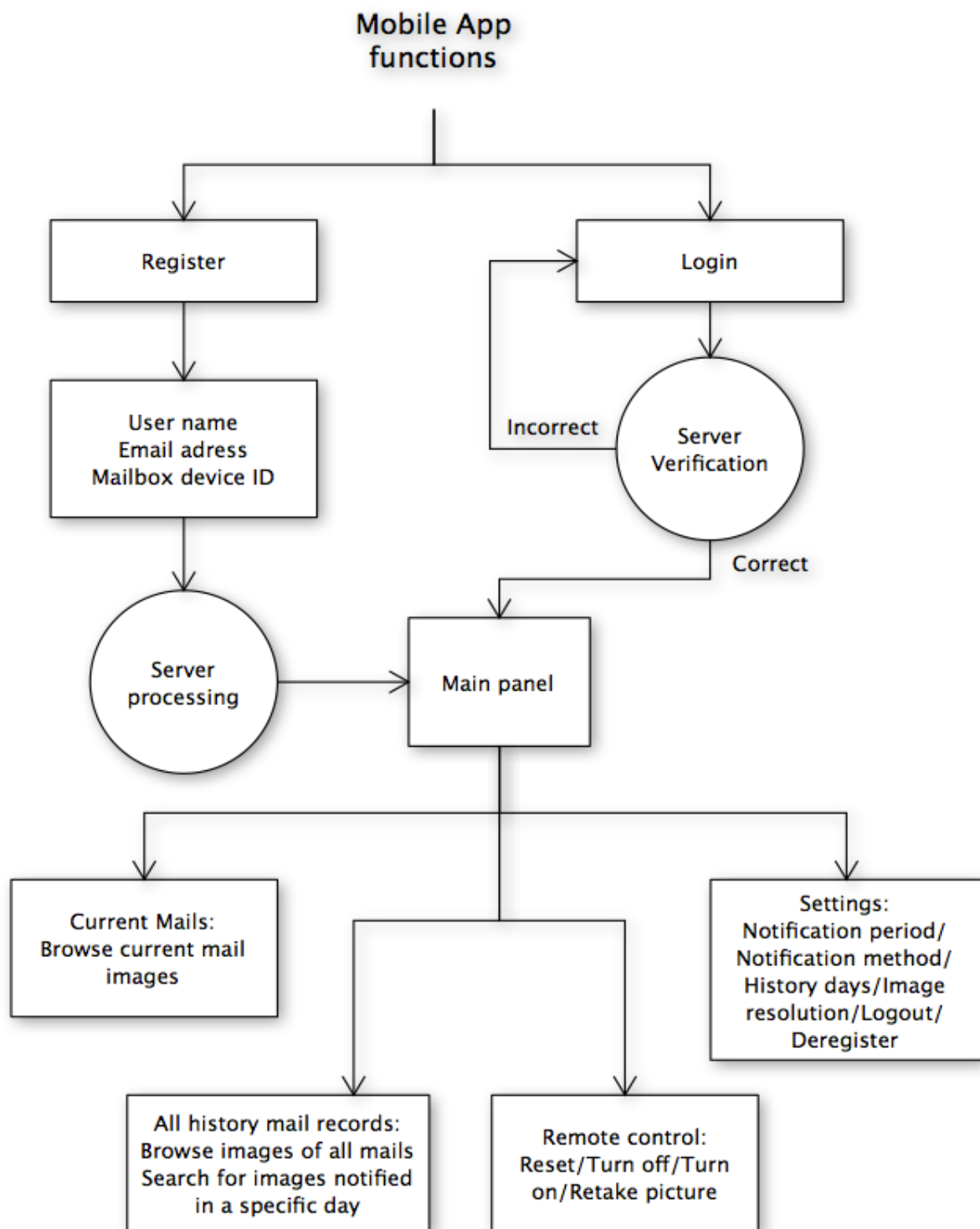
A mail delivery notification system intended to alert a user of the delivery of a new mail item inside a mailbox. The system comprises of as a device installed inside a mailbox, an internet server, and mobile software application. The device includes of a motion sensor that detects the opening and closing of the mailbox door. The device also contains a flash camera module and a digital signal processor. Upon detecting the opening and closing of the mailbox door, the device takes an image of the inside of the mailbox using the camera module. The digital signal processor analyzes this image in order to determine whether mail was placed inside the mailbox. If mail was indeed placed inside, the user receives a mobile notification from a specifically designed

application that pairs the mobile phone and mailbox of each individual user. The mobile notification also contains the image that was taken by the camera, letting the user see what mail was delivered.

**4 claims, 5 Figures.**



**FIG. 1**



**FIG. 2**

## FIELD OF THE INVENTION

The present invention relates to physical mail delivery notification systems, and more specifically, a system that connects a mailbox with a mobile phone to provide automatic mail delivery notification service.

## BACKGROUND OF THE INVENTION

Although many aspects of human life have been greatly enhanced by the increasingly growing digital technologies, the mail delivery service, and in particular the participation of customers within its process, remains almost the same as it did several decades ago. People have to go to their mailbox to check if any new mail is delivered, which can be very inconvenient. Often, a person spends time waiting and watching for the mailman to deliver the mail, in order to make sure that they don't unnecessarily go to the mailbox before the mail has been delivered. If a person does go to the mailbox before the mail has been delivered, this can be a frustrating and even tiresome experience. Therefore, it would be desirable to have a system that would notify a user's mobile phone when the mail has arrived. A mobile phone notification is far more ideal than a notification sent to a stationary receiver that is located somewhere inside the user's home or office. This is because a user is often in many different locations throughout the day, such as a car, and often would not be near a single receiving location. A mobile phone can travel everywhere with the user, and therefore the user would be able to receive the mail delivery notification at all times. Also, it would be desirable for that notification to contain an image of the mail, in order to provide the user with some information regarding the contents of the delivered mail. Several attempts have previously been made to eliminate the unnecessary need to check frequently and blindly for mail, however, the latter problem has gone unsolved.

The first generation of mail notification devices employed mechanical approaches in order

to trigger and notify. The trigger action typically is related to the opening and closing of the mailbox door by the mailman. A spring and button are used to trigger an electric signal to the system. These kind of purely mechanically triggered devices suffer from component mismatch since the buttons and springs must be precisely positioned. Therefore, installation of the device is neither easy nor universal. Users of these kind of devices often have to replace their original mailbox in order to adapt to the device.

The second generation of mail notification devices involves photoelectric sensors. A photoelectric sensor is attached inside the mailbox, and when mail comes in, the photoelectric sensor detects a blockage of light caused by the mail. This triggers a notification. While this kind of solution successfully avoids the precision problem, more inherent problems occur, i.e., the cost of a photoelectric sensor, position of the sensor with respect to light, and inability to detect new arriving mail when light is already blocked.

Another feasible approach is to use a tilt switch, as shown in U.S. patent 6,046,675. The tilt itself is a switch, which is mounted on the mailbox door, and completes a circuit if the angle of the tilt exceeds approximately 30 degrees, eliminating possible failure introduced by spring and button.

However, that product is only able to indicate new mail by lighting up an LED inside the user's home. Our invention tries to overcome many of the mentioned problems with the current devices.

## BRIEF SUMMARY OF THE INVENTION

The present system has been devised to provide a modern and intelligent solution to the demand of people who spend a large amount of time checking their mailbox frequently for incoming mail or even visit the website of postal service for any delivery update. By taking

advantage of an internet communication network, sensor transceivers, image processing, and mobile software advancement, this invention gives users instant mail notification, including a photograph of the incoming mail, by registering a device attached inside of a mailbox with a mobile application. Although a home range WiFi network is needed, the system does not require any prerequisite specifications of the mailbox itself, and thus it is highly adaptable.

For sending the notification signals, an electronic sensing and transmitting device is attached inside the mailbox. It further includes batteries, a motion sensor, a camera lens and an image processing unit integrated together with the camera lens as well as the switch on an integrated circuit chip.

The batteries are capable of being charged through an optional solar panel for better power sustainability. The solar panel is installed on top of the outer surface of the mailbox. The entire device stays in a sleeping state during night with the assumption that no mail delivery occurs at night, and effectively reduces the power consumption.

During day time, the motion sensor stays standing-by while the rest of the modules are still in sleeping state. Upon detection of an open-and-close action of the mailbox door, the motion sensor wakes up the device, to conduct a potential notification operation.

A image of the mail is captured by the camera lens installed facing the pile of mail. A simple analysis is then made by the image processing unit to determine if there is no mail, in which case it is the user himself/herself that opened the mailbox and took out the mail.

Upon the verification that new mail has been delivered, the image is transmitted through the WiFi signal, and the Internet connection thereof, to the user.

In addition to the physical device, the system employs a customized mobile software application acting as the receiver of that notification. Although certain software and algorithmic implementation may achieve an optimal experience for users to get notified, it is essentially the

concept of getting notification through mobile phone that represents this invention, regardless the underlying algorithms, mobile platforms and protocols implemented with it.

## BRIEF DESCRIPTION OF THE FIGURES

The novel features suggested as the characteristics of this invention are declared specifically in the appended claims. However, it may best to comprehend the concept, operations, advantages and further objects by referring to the following description corresponding to the accompanying illustrations.

FIG.1 is an internal workflow diagram of the mailbox device in accordance with part of the present invention.

FIG.2 is the workflow diagram of the handheld device app/software in accordance with the software part of the invention.

FIG.3 is the internal view of a mailbox containing the present invention and its different components.

FIG.4 is a standard universal latched mailbox containing the present invention.

FIG.5 is the overall workflow of the system comprising the apparatus and software of the present invention.

## DETAILED DESCRIPTION OF THE INVENTION

In this section, the invention will be explained in full detail referencing to the accompanying drawings and charts. The drawings show the preferred embodiments of the invention. However the invention should not be limited to these embodiments. Rather, these embodiments are presented to fully explain the details of the invention to those skilled in the art.

The general system of this invention is shown in FIG.5. Reference number **1** is intended to

provide a mailbox that contains the invention which has a wireless mechanism. Reference number **2** is intended to provide a common wireless router which is connected to the internet via ethernet or other technologies. Reference number **3** is intended to provide a handheld device such as a smartphone which has a connection to the internet via wireless. It should be understood that the overall system in FIG.5 may be employed in a variety of locations including commercial business locations and private residences.

Referring to FIG.3, embodiment **1** contains the apparatus which is mounted inside the mailbox on to the ceiling. Though this configuration is the preferred way, it should be noted that the apparatus can be mounted in other means. The apparatus contains a sensor **8** which is directed towards the mailbox door **10**. This sensor of course can be made of different type of sensing equipment such as infrared sensor, optical sensor, motion sensor or similar sensors that are known to the those skilled in the art.

The apparatus contains a digital camera **9** which is directed towards the floor of the mailbox. The digital camera is accompanied by a lighting system such as a flash **7** that allows clear photography in the dark environment of the embodiment **1**. The battery casing **6** is attached near to the apparatus for ease of access to change the battery that powers the apparatus. The apparatus contains a circuit board and computing devices which is enabled to transmit data through wireless signals, process images that are taken by **9** and process data sensed by **8**.

Referring to FIG.1, the diagram consists of the internal workflow, the state diagram of the software that is part of the apparatus. The general flow of the software is the following: until the door opening is sensed by **8** the apparatus remains in low power or sleep state. When **8** senses the door of the embodiment of the mailbox is opened, the apparatus goes into run state and waits until another trigger of the sensor **8** which senses that the door is closed. Then, the camera gets activated and a photograph is taken by **9**. If the lighting is not sufficient, the flash **7** is used as well. The



image processing algorithm then decides whether the mailbox is empty or if there is mail. If the decision is to that there is no mail in the mailbox, in other words if the mailbox is empty, then there is no further action taken by the software. Therefore the apparatus goes back into sleep mode. However if the image processing algorithm decides that there is mail in the mailbox, the image and other data such as the time, id of the apparatus is sent wirelessly to a server on the internet. This action can be carried out by a common wireless router **2** known to the those skilled in the art. The server processes the data, matches the id of the apparatus with the owner and sends a notification through internet to the owner's handheld device **3**. Of course the notification can also be sent via email or other similar internet protocols that are known to those skilled in the art.

Referring to FIG.4, embodiment **5** is an example of a common universal latch mailbox that is commonly found in apartment and office buildings. Reference number **4** is the apparatus that is present in the invention. This figure shows the possibility of use of the invention in such mailboxes where a universal door is opened to deliver mail.

Referring to FIG.2, as well as FIG.5, mobile application would be available in application store among the major platforms, i.e., iOS, Android and such. Users can download the application into their smartphone **3**, and therefore make use of the whole notification system. From user's perspective, the mobile application acts as the receiver, the user terminal of the system. From business's perspective, this is as an assisting implementation as the user will need to use the device ID for registering.

When registering, the user is asked for his user name, password, email address, and mailbox's device ID. When logging in, the application sends the username and password to the server, and then the server verifies the user's identity. The email address is for the case where user forgets his/her password.

After registration/login, the user is redirected to the main panel of the application, where

four major functions are presented:

- a. current mails, in which user can check the images of all the mails accumulated from the last time he/she cleared the mailbox;
- b. all history mail records, where user can get all images regardless whether they are in the mailbox, from a period of time earlier;
- c. remote control, where user can send command to the device, executing simple control functions, e.g., shutdown, restart, retake pictures and so forth;
- d. settings, with which user can configure his own preference, e.g., the available time for notification, history record period length.

As software keeps providing the best service and functions to satisfy users' demands, the functions and appearance may further change by continuous updates. Thus the figure includes but is not limiting the aforementioned appearance and functions.

Having described the preferred embodiment, other features of the present invention will undoubtedly occur to those versed in the art, as will numerous modifications and alterations in the embodiments of the invention illustrated, all of which may be achieved without departing from the spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. A mail delivery notification system that alerts a mobile device application of the presence of physical mail in a designated mailbox, comprising of:
  - a. a sensor that detects the opening and closing of a mailbox door;
  - b. a camera that takes a picture of the mailbox contents;
  - c. an image processing unit that determines if mail has been delivered;
  - d. a battery and/or solar panel;
  - e. internet access through a WiFi network;

- f. an accompanying mobile software application that receives the mail delivery notification and image.
- 2. The system as in claim 1 wherein said camera captures an image of the inside of the designated mailbox only after the sensor detects the opening and closing of the designated mailbox door.
- 3. The system as in claim 1 wherein said image processing unit analyzes the captured image in order to determine if the mailbox is empty or not.
- 4. The system as in claim 1 wherein if the mailbox has been determined to be not empty, the accompanying mobile software application contained on the user's mobile device receives a mail delivery notification and said image.

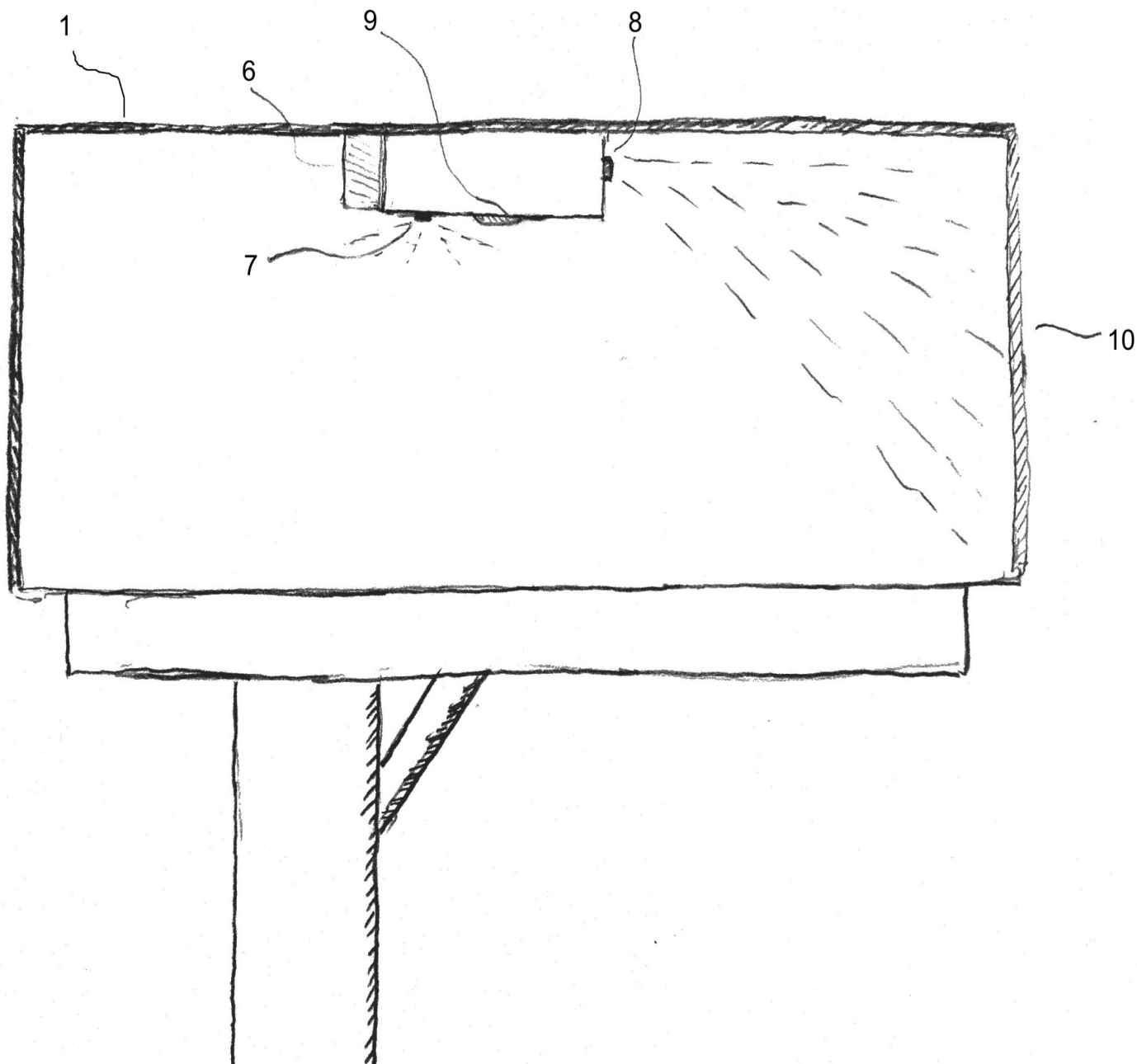


FIG. 3

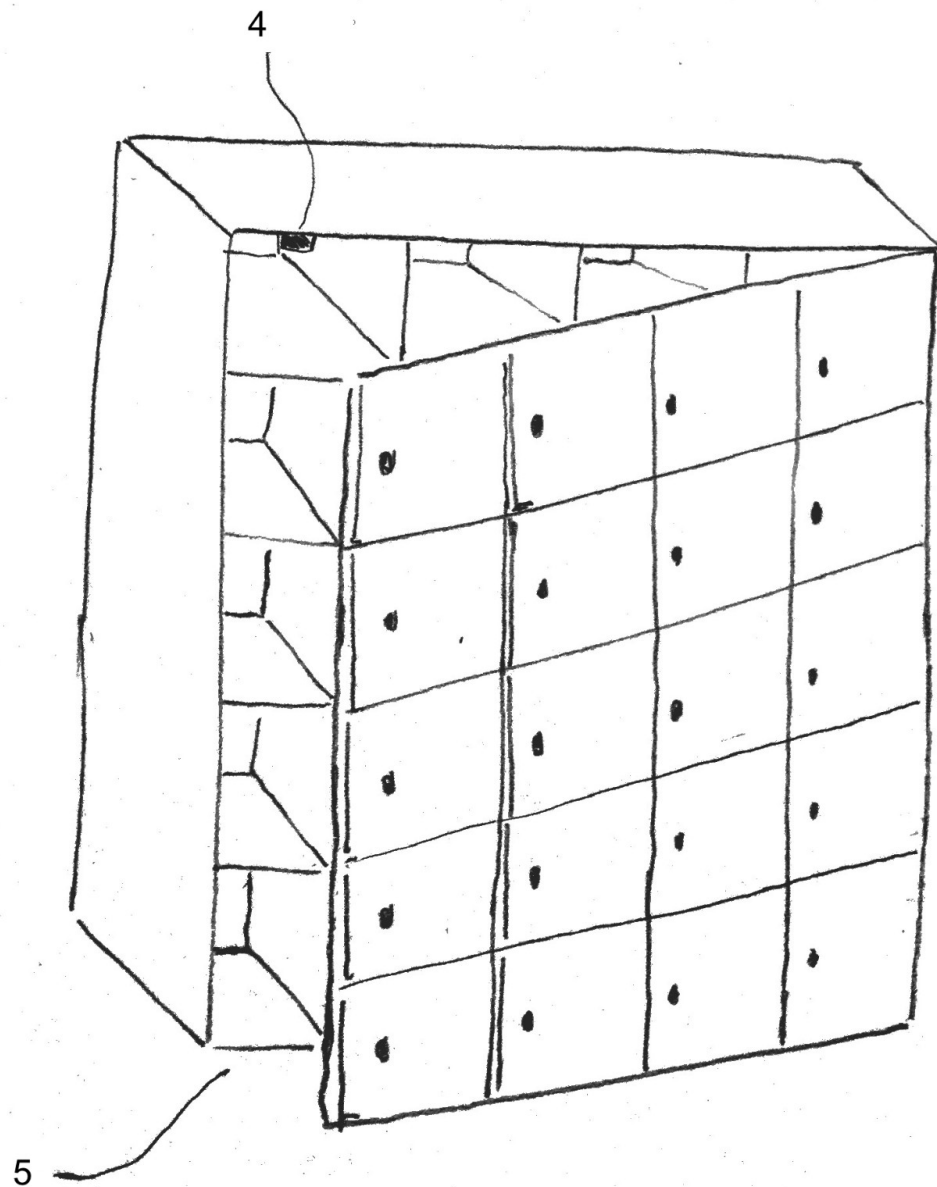


FIG. 4

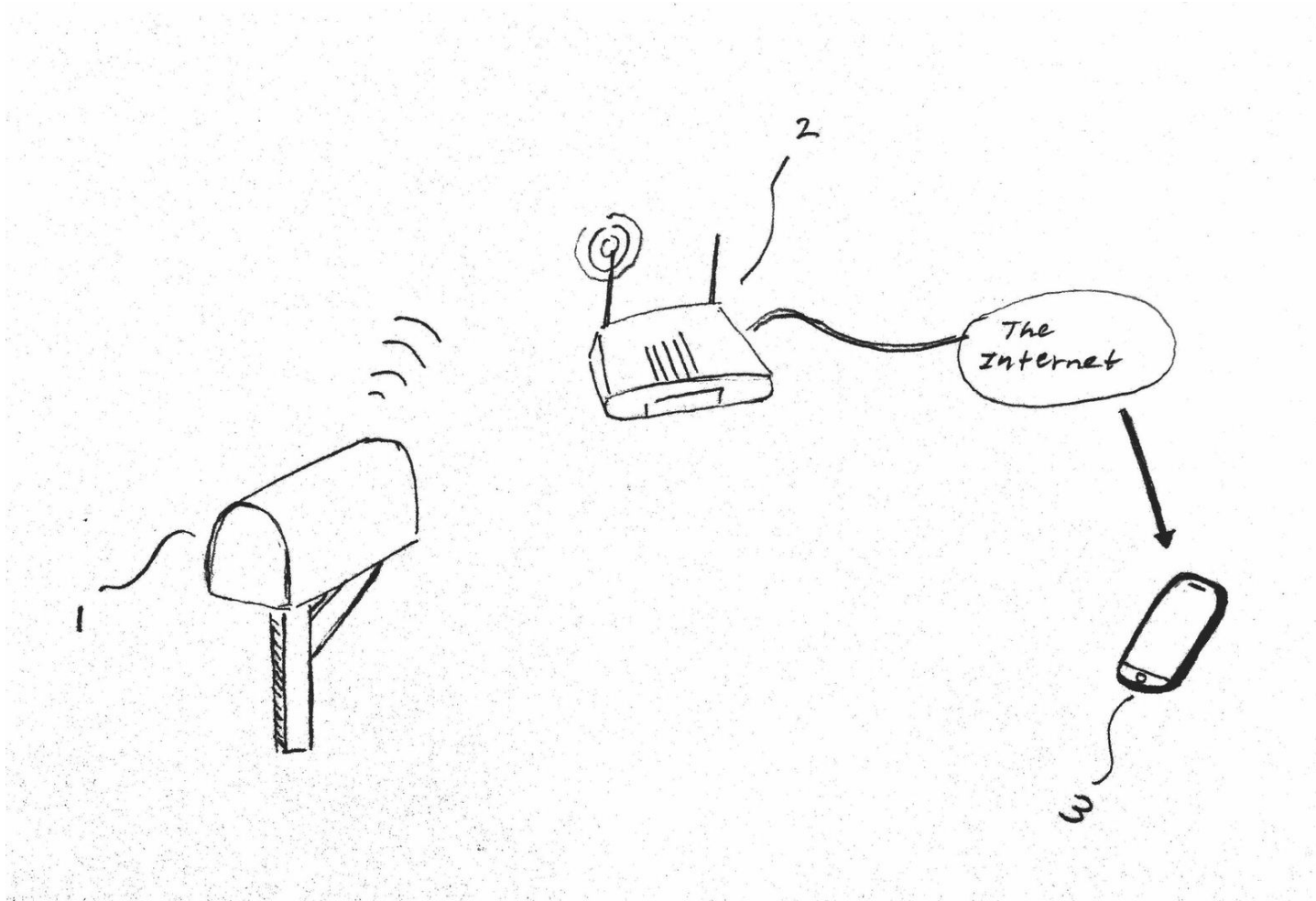


FIG. 5