ACTILE FINGERPRINT SENSOR WITH TACTILE FEEDBACK INTEGRATION

Technical field

The present invention pertains to the field of biometric technology, specifically focusing on fingerprint sensor technology integrated with force sensors for enhanced security measures in electronic devices.

Background Art

Fingerprint sensors have become ubiquitous in modern electronic devices, offering a convenient and secure method for user authentication. However, the current state-of-the-art fingerprint sensors are plagued by susceptibility to accidental touches, leading to unintended actions and compromising user experience. These sensors, commonly capacitive-based, rely on detecting the ridges and valleys of a fingerprint to authenticate users. While effective in principle, they often lack the ability to distinguish between intentional and inadvertent touches, resulting in false positives and unintended tasks being performed. This issue is particularly pronounced in devices with large touchscreens, where users frequently interact with the display, increasing the likelihood of accidental touches on the fingerprint sensor.

The existing fingerprint sensor technologies predominantly utilize capacitive sensing, which measures the electrical capacitance variations caused by the ridges and valleys of a fingerprint. While this approach has been successful in enabling compact and reliable fingerprint authentication, it falls short in differentiating between intentional and accidental touches. Additionally, the lack of a robust feedback mechanism exacerbates the problem, as users are not provided with immediate confirmation of successful fingerprint recognition, leading to repeated attempts and potential frustration.

The drawbacks of current fingerprint sensors are especially evident in scenarios where users are engaged in activities that involve frequent interaction with touchscreens, such as gaming, browsing, or using productivity applications. Accidental touches on the fingerprint sensor during these activities can lead to unintended actions, disrupting the user experience and potentially compromising the security of the device. Moreover, the absence of a reliable feedback mechanism further exacerbates the issue, as users are left unaware of whether their

fingerprint has been successfully recognized, leading to uncertainty and potential usability challenges.

In conclusion, the current state-of-the-art fingerprint sensors, while effective in principle, are marred by susceptibility to accidental touches and the lack of a robust feedback mechanism. These limitations compromise user experience, leading to unintended tasks being performed and potential security concerns. Therefore, there is a compelling need for a better and more reliable fingerprint sensor with a feedback mechanism that can accurately discern intentional touches from inadvertent ones, thereby enhancing user satisfaction and device security.

Summary of the invention

The invention introduces an actile fingerprint sensor that combines tactile feedback with fingerprint sensing technology. By utilizing pressure-sensitive materials, this innovation can detect and authenticate fingerprints while providing a tactile response upon successful recognition. The integration of tactile feedback enhances the user experience by offering a seamless and intuitive interface for fingerprint authentication. A novel algorithm processes tactile data for fingerprint recognition, ensuring accuracy and durability through the use of advanced materials. The compact and efficient tactile fingerprint sensor module also includes real-time user confirmation during authentication, improving the overall usability of the device.

Brief description of the drawings

FIG. 1 is a flowchart for triggering a fingerprint sensor in a device by sensing pressure, acquiring fingerprints, and providing real-time tactile feedback upon successful recognition to enhance user experience.

FIG. 2 is a block diagram illustrating the fingerprint sensor system with a focus on the tactile feedback mechanism and pressure sensing technology.

Detailed description

Step 100 involves the process of sensing the pressure applied by a living body using force sensors (203) that are positioned below the fingerprint sensor (202) of the device. These force sensors are crucial as they detect and measure the force exerted by the user's living body. The placement of these sensors beneath the fingerprint sensor ensures accurate measurement of the pressure applied during the fingerprint recognition process. This step is significant as it sets the foundation for the subsequent actions based on the force sensed by the sensors.

Moving on to step 101, the method includes measuring the force applied by the living body against a predefined threshold value. This step is essential to determine whether the force exerted meets the required threshold for initiating the fingerprint recognition process. By establishing a threshold value, the device can accurately assess the pressure applied by the user, ensuring that only the appropriate amount of force triggers the fingerprint sensor. This precise measurement is crucial for the device to function effectively and provide accurate fingerprint recognition.

Step 102 represents a decision point based on the comparison between the measured force and the threshold value. If the force applied by the living body meets the predefined threshold value, the process proceeds to step 103. This decision-making step ensures that the fingerprint sensor is only activated when the force exerted is sufficient for reliable fingerprint recognition. On the other hand, if the force does not meet the threshold value, the process is terminated, preventing false activations of the fingerprint sensor.

In step 103, the method involves acquiring the fingerprints of the living body using the fingerprint sensor (202) upon meeting the threshold value criteria. This action signifies the initiation of the fingerprint recognition process once the force applied by the user is deemed appropriate. Acquiring the fingerprints accurately is crucial for successful recognition and authentication purposes, ensuring the device functions as intended in verifying the user's identity.

Step 104 focuses on providing tactile feedback through a dome switch (204) and the chassis (205) of the device upon successful fingerprint recognition. This tactile feedback mechanism enhances the user experience by confirming that the fingerprint recognition process was successful. The tactile feedback through the dome switch and chassis serves as a real-time

indicator to the user, reassuring them that the fingerprint authentication was completed accurately.

Finally, in step 105, a decision is made based on the success of the fingerprint recognition process. If the recognition is successful, real-time tactile feedback is generated to confirm the successful authentication. This immediate feedback mechanism plays a crucial role in enhancing the user experience by providing instant confirmation of a successful fingerprint recognition. Conversely, if the fingerprint recognition is not successful, the process is terminated, ensuring that only valid fingerprint matches trigger the tactile feedback response.

Figure 2 illustrates the tactile fingerprint sensor system, which includes several key components. The fingerprint sensor system (200) is integrated into a device display (201), with the fingerprint sensor (202) located below the display. Positioned below the fingerprint sensor is the force sensor (203), which is responsible for sensing pressure applied by a living body. The force sensor triggers the fingerprint sensor to acquire fingerprints when the applied force meets a predefined threshold value. Additionally, a dome switch (204) is placed under the force sensor and the device chassis (205). The dome switch provides tactile feedback upon pressure being applied, enhancing the user experience.

The present invention relates to an Actile Fingerprint Sensor with Tactile Feedback Integration, comprising a fingerprint sensor system (200) designed to enhance user experience and security. The system includes a fingerprint sensor (202) positioned below a device display (201), a force sensor (203) located beneath the fingerprint sensor (202), and a dome switch (204) situated under the force sensor (203) and the device chassis (205). The force sensor (203) is configured to detect pressure applied by a living body and activate the fingerprint sensor (202) to capture fingerprints when the applied force meets a predefined threshold. Additionally, the dome switch (204) is engineered to provide tactile feedback upon the application of pressure. In one aspect, the force sensor (203) is a capacitive force sensor, which accurately measures the force applied by a living body through touch input on the device display (201). Furthermore, a controller is integrated into the system to determine if the force exerted on the force sensor (203) meets the specified threshold value, ensuring precise activation of the fingerprint sensor (202) for fingerprint acquisition. Moreover, the force sensor (203) is also configured to detect force applied by a living body through physical button

presses on the device, expanding the versatility of the fingerprint sensor system (200) to accommodate various user interactions. The dome switch (204) is designed to provide haptic feedback and can also be configured to produce an audible click sound upon being pressed, enhancing the user's tactile and auditory experience. Additionally, the fingerprint sensor system (200) further incorporates a haptic feedback generator, which is tailored to provide tactile feedback in response to the activation of the dome switch (204), further enriching the user's interaction with the device. This integration of tactile feedback mechanisms with the fingerprint sensor system (200) not only enhances user experience but also reinforces the security features by ensuring accurate fingerprint acquisition through the force sensor (203) and providing intuitive feedback through the dome switch (204). In conclusion, the Actile Fingerprint Sensor with Tactile Feedback Integration presents a comprehensive and innovative solution that combines advanced fingerprint sensing technology with tactile feedback mechanisms, offering enhanced user experience and heightened security measures.

The Actile Fingerprint Sensor with Tactile Feedback Integration comprises several key components that work together seamlessly to provide a unique user experience. At the core of the system is the Fingerprint Sensor System (200), which is strategically positioned beneath the Device Display (201). This setup allows the Fingerprint Sensor (202) to capture the fingerprints of a user when prompted. The Device Display (201) serves as the interface through which the user interacts with the device, seamlessly integrating the fingerprint sensor technology.

Complementing the Fingerprint Sensor (202) is the Force Sensor (203), which is located below the fingerprint sensor. The primary function of the Force Sensor (203) is to detect and measure the pressure applied by a user's living body. By setting a predetermined threshold value, the Force Sensor (203) can accurately gauge the force exerted on it. When the force applied surpasses the threshold value, it triggers the Fingerprint Sensor (202) to capture the user's fingerprints effectively.

In addition to the Force Sensor (203), the system incorporates a Dome Switch (204) positioned beneath both the Force Sensor (203) and the Device Chassis (205). The Dome Switch (204) plays a crucial role in providing tactile feedback to the user. When the switch is pressed, it offers a physical response, notifying the user that an action has been initiated. This tactile

feedback mechanism enhances the overall user experience by providing a tangible response to the user's interactions with the device.

The integration of these components in the Actile Fingerprint Sensor with Tactile Feedback system ensures a seamless and intuitive user experience. As the user applies pressure on the Force Sensor (203), the system responds by activating the Fingerprint Sensor (202) to capture the necessary fingerprints. The tactile feedback provided by the Dome Switch (204) enhances the user's engagement with the device, making the interaction more intuitive and user-friendly.

Overall, the Actile Fingerprint Sensor with Tactile Feedback Integration offers a novel approach to fingerprint recognition technology by combining tactile feedback elements with advanced sensor technology. This innovative system not only enhances security measures but also improves user experience by providing intuitive feedback during interactions.

Claims

1. A fingerprint sensor system comprising:

a fingerprint sensor (202) located below a display (201) of a device;

a force sensor (203) disposed below the fingerprint sensor (202);

a dome switch (204) placed under the force sensor (203) and the chassis (205) of the device;

wherein the system is characterized by the force sensor (203) sensing pressure applied by a living body and triggering the fingerprint sensor (202) to acquire fingerprints when the force applied meets a threshold value; and

wherein the dome switch (204) is characterized in that it provides tactile feedback upon pressure being applied.

2. The fingerprint sensor system of claim 1, wherein the (203) force sensor is a capacitive force sensor.

3. The fingerprint sensor system of claim 1, further comprising a controller configured to determine if the force applied on the (203) force sensor meets the threshold value.

4. The fingerprint sensor system of claim 1, wherein the (203) force sensor is configured to measure the force applied by a living body through a touch input on the (201) display.

5. The fingerprint sensor system of claim 1, wherein the (203) force sensor is further configured to detect the force applied by a living body through a physical button press on the device.

6. The fingerprint sensor system of claim 1, wherein the (204) dome switch provides haptic feedback upon being pressed.

7. The fingerprint sensor system of claim 1, wherein the (204) dome switch is configured to provide an audible click sound upon being pressed.

8. The fingerprint sensor system of claim 1, further comprising a haptic feedback generator configured to provide tactile feedback in response to the (204) dome switch being pressed.

9. A method for triggering a fingerprint sensor (202) in a device, the method comprising:

sensing pressure applied by a living body using force sensors (203) disposed below a fingerprint sensor (202) located below a screen or display (201) of the device;

measuring the force applied against a threshold value;

acquiring fingerprints of the living body using the fingerprint sensor (202) when the force applied meets the threshold value;

providing tactile feedback through a dome switch (204) placed under the force sensor (203) and the chassis (205) of the device upon successful fingerprint recognition;

characterized in that the tactile feedback is generated in real-time to confirm the successful fingerprint recognition and enhance user experience.

10. The method of claim 9, wherein the force sensors (203) are capacitive force sensors, resistive force sensors, piezoelectric force sensors, or optical force sensors.

11. The method of claim 9, wherein the threshold value is adjustable based on the user's preference or environmental conditions.

12. The method of claim 9, further comprising generating an alert if the force applied on the force sensor (203) does not meet the threshold value after a predetermined number of attempts.

13. The method of claim 9, wherein the fingerprint sensor (202) utilizes ultrasonic technology, optical technology, or capacitive technology to acquire the fingerprints of the living body.

14. The method of claim 9, wherein the tactile feedback is provided through a haptic feedback system integrated into the device chassis (205).

15. The method of claim 9, wherein the tactile feedback is accompanied by a visual confirmation displayed on the screen or display (201) of the device upon successful fingerprint recognition.

16. The method of claim 9, wherein the force applied is measured in real-time and the fingerprint sensor (202) is triggered without requiring a separate action from the user.

17. The method of claim 9, wherein the force sensors (203) are arranged in an array to capture pressure distribution across the fingerprint sensor area.

Abstract

The invention presents an actile fingerprint sensor, integrating tactile feedback with fingerprint sensing technology. It utilizes pressure-sensitive materials to detect and authenticate fingerprints, generating a tactile response upon successful fingerprint recognition. This innovation enhances user experience through the combination of tactile and biometric authentication, employing a novel algorithm to interpret and process tactile data for fingerprint recognition. The invention introduces a seamless and intuitive user interface for fingerprint authentication, ensuring durability and accuracy of tactile fingerprint sensing through advanced materials. It also develops a compact and efficient tactile fingerprint sensor module, integrating tactile feedback to provide real-time user confirmation during fingerprint authentication.

Figures

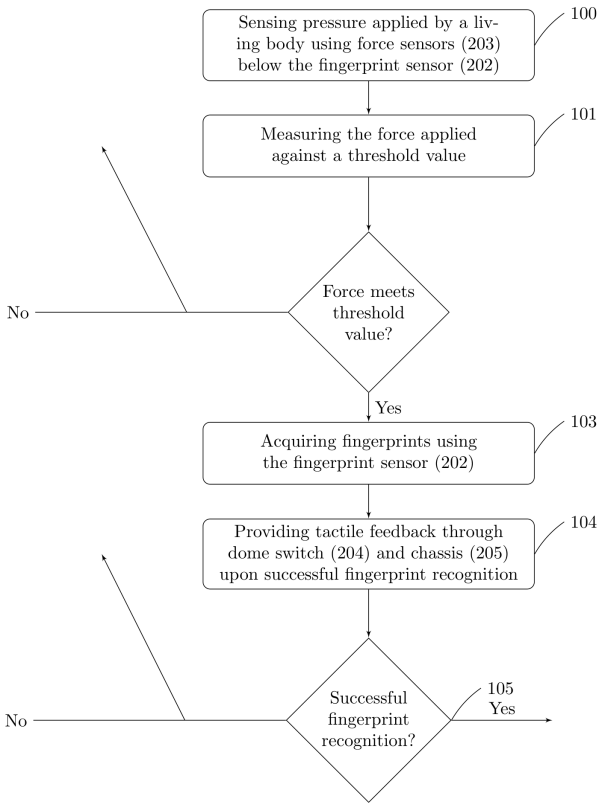

Fig. 1

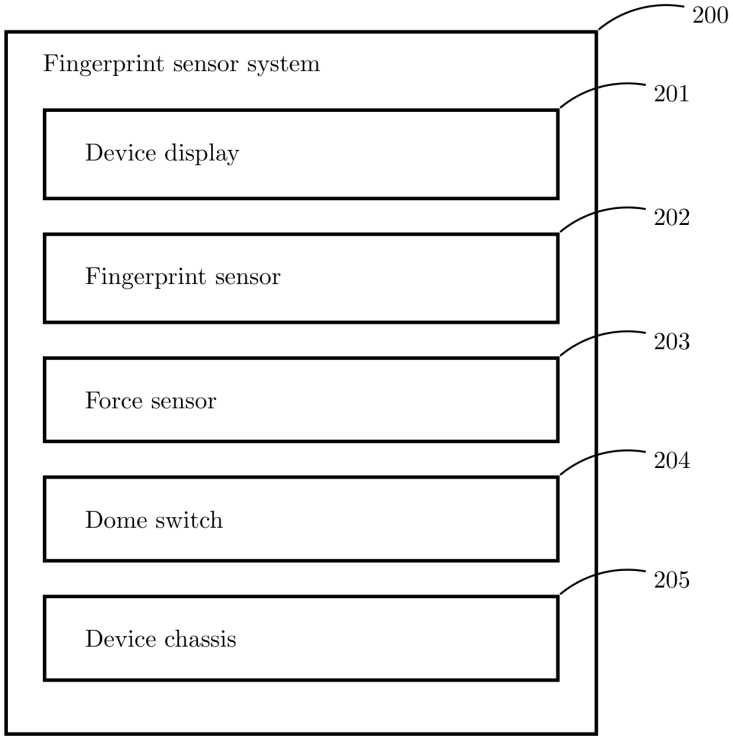
200
Fingerprint sensor system
201
Device display
202
Fingerprint sensor
203
Force sensor
204
Dome switch
205
Device chassis

Fig. 2