A Framework for IoT-Enabled Virtual Emotion Detection in Advanced Smart Cities

Research Paper Summary

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0.1 An abstract

Numerous studies have looked into the possibility of accurately identifying human emotion from facial expressions and motions. In instance, recent notable technological breakthroughs have made it possible to detect human mood via wireless transmission. The notion of barrier coverage in IoT-enabled environments is introduced in this paper along with a new framework for emotion detection in advanced smart cities. The suggested framework enables IoT devices to build a VEmoBar, or virtual emotion barrier, which can detect human emotion via a wireless signal and its reflection. On the basis of this framework for virtual feeling, we also talk about upcoming problems and challenges for prospective smart cities.

Introduction

Humans are the only species capable of producing emotion, making it a distinctive trait of humans. There are various research areas related to the identification of human emotion. First, utilising cameras and audio and visual data such as voice, facial expression, gesture, or motion detection, the emotion can be determined. Additionally, it's possible to assess emotion using physiological signals such as heart rate and body temperature using wearable technology and body sensors. An important emotion recognition system was recently developed by researchers employing wireless signals reflected by the human body. When compared to other systems, the wireless signal-based approach in particular has certain advantages. Since wireless signals may penetrate walls and other solid objects, emotion recognition using wireless signals offers better coverage than emotion recognition using cameras. Additionally, wireless signal-based solutions can lessen privacy concerns because cameras may accidentally record sensitive information about people, like a user's face. The Internet of Things (IoT) is a well-known idea that could lead to appropriate emotion-based services. It is thus possible to determine the person's emotions by their feature extractions after an IoT device emits a wireless signal to a human and receives heartbeat and respiratory signals through its reflection. It follows that an IoT-enabled system can provide individuals with quick and tailored services based on the detection of emotions if it can identify specific groups with serious emotions like strong anger and fury and can continuously monitor specific places with those emergent scenarios. Following the recognition of emotions, it is feasible to provide the person specialised services. These emotion-based services for inhabitants are expected to aid in the creation of successful advanced smart cities. Any movement or object penetration between one region and another will be sensed by at least one device inside the established barrier if we use a group of devices to create a barrier inside a specific area. To pursue highly accurate emotion detection by IoT-enabled barriers, we should, however, take into serious consideration the fact that wireless signals may return variable emotion accuracy depending on the distance between device and item. We create a system that enables IoT device barriers to give virtual emotion detection. In contrast, we formally describe the k-MaxCAEmo problem, the goal of which is to create k virtual emotion barriers in the given region while maximising the total accuracy of those barriers. We next suggest the Max-k-Cumulative-Accuracy-Selection technique to address the issue, which returns k virtual emotion barriers with the highest cumulative accuracy for emotion identification. Additionally, thorough simulations with a variety of scenarios are used to assess how well the suggested method performs.

The framework and architecture

Assumptions and settings: 1. The suggested system aims to identify four emotion types—joy, pleasure, sadness, and anger—for the purpose of categorising emotions. 2. Heterogeneous IoT

devices with different maximum signal ranges are located at the square-shaped area. 3. Each IOT device has the capability of transmitting wireless signals to a person within the signal range, and it also contains processes for determining and detecting four different emotion types through wireless signal reflection. 4. Depending on how far away the person is from the IoT device, the accuracy of emotion detection based on wire-free signals can vary. Additionally, the system has pre-set accuracy rate data based on the device's wireless signal range. 5. The system can retain the identified emotion information as data or a form of multimedia like speech and video, and it can also send it to other organisations. When compared to previous emotion detection techniques based on audio/video information and physiological signals, it is also highlighted that emotion recognition by wireless signal has a number of advantages, including increased coverage and lower privacy. Each IOT device has a wireless signal, so it can transmit the signal and receive its reflection in order to derive human emotions using pre-installed processing units for heartbeat segmentation, respiration signal, and feature extraction through the reflection of a wireless signal. The resulting emotion is then described as a virtual emotion that can be stored as editable data and sent to other devices in AI-enabled apps. Additionally, it is well known that the accuracy of emotion recognition declines with increasing distance between a person and an IoT device for wireless signal. For instance, a 10 m distance between the IoT device and the human results in a higher accuracy of emotion recognition than a 20 m distance. As a result, the accuracy problem needs to be addressed seriously in applications that deal with emotions, and our method considers how to derive a correct virtual feeling. Based on this finding, we develop a brand-new type of virtual emotion barrier we call VEmoBar to provide accurate emotion recognition in an area with lots of IoT devices. The proposed barrier concept is described as follows. In order for the Internet of Things to sense and infer virtual emotions utilising a wireless signal and its reflection, a group of IoT devices must be arranged in a square-shaped region. The VEmoBar is a virtual emotion barrier that tracks the emotions of people when they cross between two sides.

Conclusion

The suggested method used the assumption that IoT devices could recognise four different emotion categories, including happiness, pleasure, sorrow, and rage. The development of a light system that can only detect a particular sort of emotion is appropriate given the demand and goal of the pursuing system. For instance, each IoT in a light system only focuses on detecting a single form of emotion, so we can create a system that seeks to extract just one or a few types of emotions rather than all emotion types in order to make the system lighter. Finding the right number of devices and arranging them in a way that maintains the same number of VEmoBar in a particular area might also be one of the challenges. The successful implementation of future advanced smart cities shall depend heavily on the provision of services based on human emotion via IoT devices. We created a system that can detect virtual emotion using VEmoBar that is composed of heterogeneous IoT devices in order to secure a bridgehead for those emotion-based services in IoT and AI-enabled smart cities. To the best of our knowledge, this is the first effort to offer the idea of a virtual emotion barrier suitable for Internet of Things environments, where the detected data may be both stored in the suggested infrastructure as manipulable data and transferred to other entities.