Technical Disclosure Commons

Defensive Publications Series

March 21, 2019

Combined timeline and event detection for Internet of Things (IoT) data feeds

Saptarshi Bhattacharya

Shreedhar Madhavapeddi

Combined timeline and event detection for Internet of Things (IoT) data feeds

ABSTRACT

Different Internet of Things (IoT) devices capture data relevant to respective functions and transmit such data over the Internet such that it can be stored and accessed by the user. Typically, such data access is limited to the respective single IoT device. Examining data from multiple IoT devices requires the user to check the data feed from each device separately. This disclosure describes techniques to combine data feeds from multiple IoT devices and sensors to generate a single combined data timeline with the user's permission. The timeline is processed and filtered via smart algorithms to derive and mark events of likely interest to the user. Interactive user interfaces are provided for the user to query and obtain relevant information of interest from the combined event timeline. Such user interfaces can be provided via, e.g., a virtual assistant, a web browsers, a mobile app, etc.

KEYWORDS

- Internet of Things (IoT)
- IoT feed
- Sensor data
- Event timeline
- Virtual assistant
- Event detection model

BACKGROUND

Several common household devices and sensors, e.g., thermostats, security cameras, etc., are nowadays connected to the Internet. Such Internet-connected physical objects are referred to as Internet of Things (IoT) devices. Different Internet of Things (IoT) devices capture data relevant to respective functions and transmit such data over the Internet such that it can be stored and accessed by the user. The data is stored in the cloud and accessed via the Internet using various applications, such as a web browser, a dedicated app for the IoT device, a virtual assistant, etc. Typically, such data access is limited to the respective single IoT device. Examining data from multiple IoT devices requires the user to check the data feed from each device separately. As a result, the user cannot easily discern and act upon information that can be obtained only by combining data feeds of more than one IoT device.

DESCRIPTION

This disclosure describes techniques to combine data feeds from multiple IoT devices and sensors to generate a single combined data timeline with the user's permission. The timeline is processed and filtered via smart algorithms to derive and mark events of likely interest to the user. Interactive user interfaces are provided for the user to query and obtain relevant information of interest from the combined event timeline. Such user interfaces can be provided via, e.g., a virtual assistant, a web browsers, a mobile app, etc.

For example, the smart algorithms used with the user's permission to process and/or filter the combined IoT timeline can use appropriate trained machine learning models. For example, data from cameras can be analyzed by models that process images from video feeds. The trained models can detect key events of likely interest to the user. In another example, the data feed from an IoT mailbox can be used to mark the time at which the user's mail was delivered. Alternatively, with the user's permission, the output of the models can provide information of interest in aggregate. For example, the combined timeline of data feeds from several IoT devices and sensors can yield information such as "the dog took 2 walks and slept for 3 hours while the dog-sitter was looking after it." If permitted by the user, event detection can be performed offline. The user can also specify preferences and queries in advance to guide offline event detection. In addition, the event detection can be performed on-demand based on the user's query.

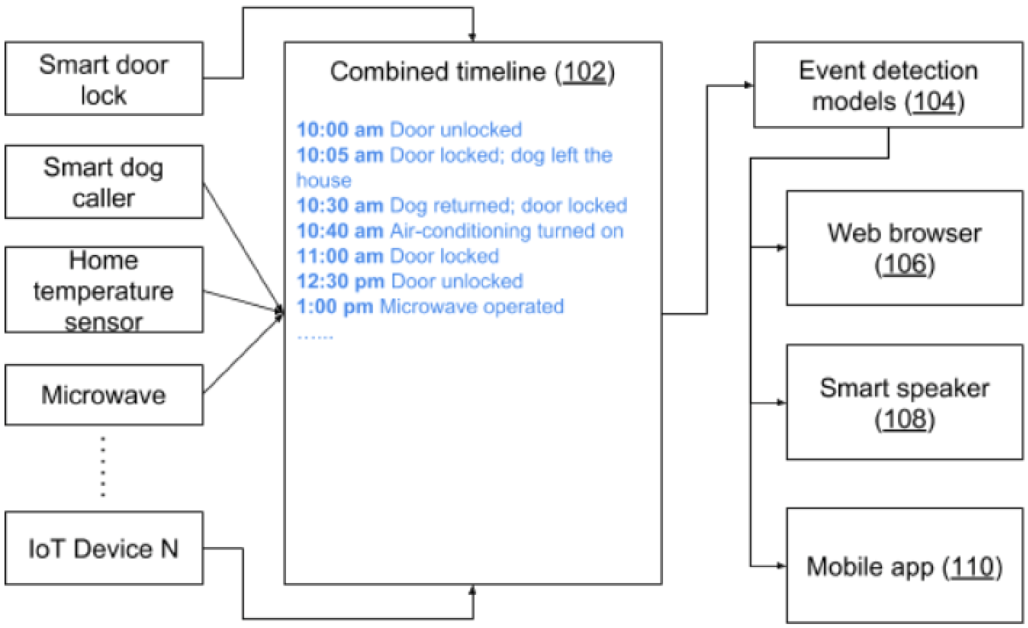

Fig. 1: Generating a combined IoT timeline and detecting events of interest

Fig. 1 shows an example operational implementation of the described techniques. With user permission, data from a number of IoT devices is gathered and combined to generate a single data timeline (102) across multiple devices of the user. Data from devices for which the user denies permission is not accessed and is excluded from the timeline. If the user permits, trained event detection models (104) are applied to the timeline to detect key events and time spans of likely interest to the user. The event and time span detection can occur offline and/or be triggered when the user performs a query. The user can request information regarding events or time spans of interest within the combined IoT timeline via, e.g., a web browser (106), a virtual assistant, e.g., provided by a smart speaker (108) or another device, a mobile app (110), etc.

The techniques of this disclosure can be applied in consumer as well as enterprise domains. In the consumer domain, the described techniques can help keep track of domestic activities. In the enterprise domain, the techniques can be used to detect events of business interest and possibly to automate relevant tasks.

In the consumer domain, the techniques can derive information by combining data feeds from domestic IoT devices and sensors. For example, if the user permits, the combined timeline of data gathered from IoT pet monitors, thermostats, cameras, etc. can be used to generate and provide information pertaining to a pet, such as length of sleep, number of exercise events, times of feeding, etc. Moreover, the timeline can be used to compute relevant statistics and correlations, such as the relationship between sleep and room temperature, to answer queries such as "What might be causing the dog to wake up intermittently?"

Similarly, the described techniques can provide the ability to use the combined IoT timeline know about various household matters of interest. For example, with permission from the relevant parties, the techniques can indicate when certain tasks, such as lawn mowing or cleaning, were completed and how long it took to perform the work.

In the enterprise domain, the techniques can be used by various businesses to detect events of business interest and possibly to automate relevant tasks. For example, with permission from appropriate parties, a car parking garage can use the combined timeline generated using data from various IoT devices and sensors, such as entrance and exit cameras, parked car detection sensors, etc., to determine occupancy of various available parking spaces, entry and exit times of individual cars, etc. These can in turn be used for a variety of relevant business tasks such as calculating parking fees, determining parking space availability, etc.

The trained event detection models provide intelligence to automatically derive information of interest from the timeline of combined data from various IoT devices and sensors. Advanced user interface technologies, such as voice-based UI, enable the derived intelligence to be provided in a user friendly and effective manner and enhance the utility of individual IoT devices. Detection and automation of enterprise functions enabled by the described techniques can result in improved operational efficiency and reduced costs for businesses.

Further to the descriptions above, a user may be provided with controls allowing the user to make an election as to both if and when systems, programs or features described herein may enable collection of user information (e.g., information about a user's social network, social actions or activities, profession, a user's preferences, or a user's current location), and if the user is sent content or communications from a server. In addition, certain data may be treated in one or more ways before it is stored or used, so that personally identifiable information is removed. For example, a user's identity may be treated so that no personally identifiable information can be determined for the user, or a user's geographic location may be generalized where location information is obtained (such as to a city, ZIP code, or state level), so that a particular location of a user cannot be determined. Thus, the user may have control over what information is collected about the user, how that information is used, and what information is provided to the user.

CONCLUSION

This disclosure describes techniques to combine data feeds from multiple IoT devices and sensors to generate a single combined data timeline with the user's permission. The timeline is processed and filtered via smart algorithms to derive and mark events of likely interest to the user. Interactive user interfaces are provided for the user to query and obtain relevant information of interest from the combined event timeline. Such user interfaces can be provided via, e.g., a virtual assistant, a web browsers, a mobile app, etc. Trained event detection models provide intelligence to automatically derive information of interest from the timeline of combined data from various IoT devices and sensors. Advanced user interface technologies, such as voice-based UI, enable the derived intelligence to be provided in a user friendly and effective manner and enhance the utility of individual IoT devices. The techniques can be applied in consumer as well as enterprise domains.