

## I<sup>3</sup> Use Cases

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## I<sup>3</sup> Use Cases

**Crisis Management: (1) want to be able to dispatch security services based on crowd levels. (2) Explicitly track all personnel (students + security) during emergency situations. (3) Managed multimode emergency information system**

### Steps

- Students register with I<sup>3</sup> and turn on cellphone location data so parents and campus security can track them through the campus (and nobody else).
- Campus security personnel turn on cellphone location data so their location can be tracked during their shift.
- Building access/exit points equipped to count total in a building
- Security center has application to show total identified and unidentified people in a building
- When count of unidentified exceeds a building specific threshold, security people are dispatched as a precaution
- When a security person declare a crisis, instructions are transmitted to electronic signage in and around the building (shelter messages inside the building and lockdown messages outside the building)
- Security personnel work room by room to clear building of identified people (identified people location within the building is known)
- Security personnel work to find and clear building of any unidentified people (no building specific information available)

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## I<sup>3</sup> Use Cases

**Student Validation: Students cellphone registers location based on their passing a beacon (checkin at cafeteria and dorm room)**

### Steps

- Students register their cellphone with I<sup>3</sup>.
- Students download a generic I<sup>3</sup> client to their cellphone that continually scans for beacons
- When the cellphone detects a beacon, the client software gets the beacon identification and reports its detection to the I<sup>3</sup> system as the currently local beacon when it is in range.
- When the cellphone detects that it is out of range of the beacon, the client software reports loss of beacon contact to the I<sup>3</sup> system.
- When the cellphone detects that it has left the range of one beacon and entered the range of another overlapping beacon, the client software reports detection of the new beacon contact to the I<sup>3</sup> system
- System supports virtual class attendance record keeping, manages access to dorm cafeteria and access to school buses
- Systems allows students to find classmates for project assignments and to locate professors for roving office hours

## I<sup>3</sup> Use Cases

**Inventory Tracking: Packages, equipped with beacon when they leave the supplier, are tracked as they proceed through the supply chain to a warehouse, are stored and then distributed to their target location.**

### Steps

- The shipping companies equip trucks and depots with beacon detectors.
- Vendors equip their shipping docks with beacon detectors.
- The warehouse has beacon detectors installed throughout the warehouse.
- Vendor register a beacon with I<sup>3</sup> system prior to giving the package to a delivery company for shipment to a warehouse.
- When the beacon is detected by a beacon detector (e.g. Raspberry Pi based system) as leaving the vendor's property, the beacon detector reports the change in location of the package to the I<sup>3</sup> system.
- When the beacon is detected by a shipping company's beacon detector as being on a truck or in a depot, the beacon detector reports the change in location of the package to the I<sup>3</sup> system.
- When the beacon arrives at a warehouse, the beacon detector reports to the I<sup>3</sup> system the location of the inventory
- If the beacon, attached to the inventory moves within the warehouse, the beacon detectors will report the change in location
- When the beacon moves to the loading dock, its movement is tracked by the I<sup>3</sup> system as it is shipped to its end location.
- When the beacon is detected by a shipping company's beacon detector as being on a truck or in a depot, the beacon detector reports the change in location of the package to the I<sup>3</sup> system.

## I<sup>3</sup> Use Cases

**Virtual Watchman at a Construction Site:** Virtual watchman uses detectors (video, audio, heat) in a room to detect if unexpected activity exists. When activity is detected, alarms are sounded to bring video/physical attention to the room

### Steps

- Phase 1: Video camera, audio detector, and heat detectors are connected to an in-room security controller (e.g. Raspberry Pi based system)
- The in-room security controller is defined to the I<sup>3</sup> system.
- The in-room security controller is defined a schedule. The I<sup>3</sup> system auto-activates and deactivates the in-room security controller according to the schedule.
- The in-room security controller will alert the I<sup>3</sup> system when activity is detected in the room. When the room is expected to be occupied the device will not be activated so the alerts will be ignored.
- When the in-room security detects activity in a room that is scheduled to be inactive, alerts messages will be sent to application users. If the user does not acknowledge the alert within the timeout period, messages will be escalated to other users.
- Phase 2: The I<sup>3</sup> system will send a control signal to the in-room security controller when inappropriate activity is detected in order to start the flow of video and audio back to the I<sup>3</sup> system. These data streams will be stored on disk
- Phase 2: The alerted operators will have the option to viewing and/or listening to the stored data streams

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## I<sup>3</sup> Use Cases

**Tool Tracker at a large manufacturing site:** Personnel, Tools/equipment, Facility supplies (boxes) are tracked in depots, on trucks and scheduled to orchestrate maintenance activity.

### Steps

- Beacon detectors are placed throughout the facility (e.g. Raspberry Pi based system)
- Administrative officials register with the I<sup>3</sup> system and then register their beacons.
- Administrative officials give read-only access to personnel who need to be able to locate the equipment in question
- Beacons are placed inside the property to be tracked such as delivery carts, university tools, etc
- When the beacon, attached to the property, is detected by a beacon detector (e.g. Raspberry Pi based system), the beacon detector reports the property being within its purview to the I<sup>3</sup> system
- When the beacon, attached to the property, is detected as having left the purview of the beacon detector, the beacon detector reports to the I<sup>3</sup> system the property has left its purview
- When the beacon, attached to the property, moves from one beacon detector purview to another, the second beacon detector, will report to the I<sup>3</sup> system that the property is now within its purview

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## I<sup>3</sup> Use Cases

Truck Tracker: trucks, tractors, harvesters, graders, flatbeds, mobile homes, porta potties can be tracked for location and usage allowing support of new business models

### Steps

- Cellular networks are used to track location and usage statistics of large mobile assets
- Owners register low-jack or other types of location reporting devices associated with the equipment.
- Location changes are tracked and a change in location triggers new billing considerations.
- Some devices will be billed as stationary assets where the device is functionally disabled until its location stabilizes and a party registers to be responsible for use at that new site.
- Some devices will be billed as mobile assets where the device is disabled when it is stable for a period of time and requires reauthorization before the asset can be moved to a new location.
- Asset owner always know who is responsible for the asset, the assets operational state, and location.

## I<sup>3</sup> Use Cases

Sporting Health: Activities of student athletes, professional, and semi-professional athletes are monitored for physical activity, diet, and location to optimize their training regimen

### Steps

- Students athletes register their cellphone with the I<sup>3</sup> system
- Students are issued fit-bit type trackers to monitor their heartbeat
- Health monitoring software is downloaded to the student cellphone to track diet, steps, etc
- When students athletes log food intake, reports are transmitted to the I<sup>3</sup> system along with location information
- Other health measures are polled from the I<sup>3</sup> system. During the athletic season, polls are done hourly and during off-season, information is polled every 8 hours
- Physical activity and eating habits are reviewed by the coaching staff in an effort to improve athlete performance.

## I<sup>3</sup> Use Cases

**Wellness Health:** Consumers interested in maintaining a healthily lifestyle is monitored for physical activity, diet, and location. Wellness reports are generated for the consumer and emergency reports are generated for medical staff when conditions warrant

### Steps

- Consumers buy an over the counter health trackers
- Consumers athletes register their cellphone with the I<sup>3</sup> system if the health monitoring system is Bluetooth based. If the system has direct cellular capabilities, the device itself is registered with the I<sup>3</sup> system
- Data is periodically collected from the device to the I<sup>3</sup> system
- Data is compared against norms to determine if a health risk is detected. If a risk is detected emergency signals may be sent to a doctor and/or emergency contact.
- Data is also compared to consumer specified target health levels and if goals are in jeopardy of not being met, alerts are sent to the consumer so corrective action can be taken (e.g. an evening exercise session)
- If target levels are achieved early, congratulatory messages are sent to the consumer and possibly others in a wellness support group
- End of day reports are sent to the consumer

## I<sup>3</sup> Use Cases

**Station Management:** Bus/Train Stations are busy and often confusing places. Luggage can be tagged with beacons so it is tracked, passengers can log in so any missing passengers are quickly located, support personnel and support resources can be tracked in a busy station.

### Steps

- Beacon detectors are placed by train and bus stops near the campus (e.g. Raspberry Pi based system)
- Transportation and security personnel register their cellphone with the I<sup>3</sup> system so their location can be tracked.
- Administrative officials give read-only access to personnel so they can find co-workers and security personnel when needed
- Beacons may be attached to luggage to track its physical location as a service to passengers.

## I<sup>3</sup> Use Cases

**Government Support:** Cities can collect data from traffic sensors and citizen contributed data to build living databases that can be sold to companies as a non-tax source of revenue.

### Steps

- Citizens register their cellphone with the I<sup>3</sup> system so their location information can be tracked.
- Citizens agree to release their location information to the city government allowing the city to sell citizen movement records as marketing data to interested corporate entities as a source of non-tax revenue.
- Citizens receive periodic reports thanking them for their data and reporting how much non-tax revenue the citizens are helping the city to raise.
- Citizens have an 'emergency' button on their cellphone that sends an alert to the police if they need local help.
- Citizens have an 'emergency' button on their cellphone that sends an alert to the police if someone else needs help (e.g. a family member who has also registered to participate in the program) and an alert is sent to the police with the location of the family member.

## I<sup>3</sup> Use Cases

**Electric Support:** Electric utility networks are complicated systems with many moving parts. Dispatching repair personnel to correct outages can be made more efficient by scheduling people, tools, and supplies to be at the right place at the right time. Data inputs from homes and distribution networks can be integrated into the alerting system rather than waiting on customer complaints to signal a failure.

### Steps

- Field personnel, vehicles, and tools are defined in a scheduling software system that includes support for APIs.
- Field personnel register their smartphones to the I<sup>3</sup> system so location updates are sent to the I<sup>3</sup> domain controller
- Vehicles are equipped with beacon detectors (e.g. Raspberry Pi based system) and the detectors are programmed to report the vehicle location with each beacon detection.
- Tools and supplies are equipped with a beacon
- When tools and supplies are loaded to a vehicle, an alert is sent to the I<sup>3</sup> system notifying the system that the tools are now onboard the vehicle.
- As the vehicle moves, the change in location is reported to the I<sup>3</sup> system.
- As the field personnel move, the change in location is reported to the I<sup>3</sup> system
- I<sup>3</sup> reports the location of people, vehicles, tools and supplies to the scheduling program.
- The scheduling program can create action tickets based on current status and optimized for efficiency; these schedules can be emailed to field personnel and their managers in response to outage notices from customers.
- Home IOT equipment that is connected to the I<sup>3</sup> system can auto-trigger a dispatch without manual customer intervention.

## I<sup>3</sup> Use Cases

**Amber Search:** When children go missing, amber alerts are used to send out messages but it is difficult to tell who has received the message and who is assisting in the search. Imagine an amber alert where people positively acknowledge they will help in the search and then you are able to coordinate these citizen helpers to properly cover targeted areas.

### Steps

- Citizens register their smartphones to the I<sup>3</sup> system as amber volunteers
- When an amber alert is issued, it triggers a program on the cellphone that asks the volunteer if they are able to participate in the search.
- Citizens that respond positively begin transmitting their location information back to the I<sup>3</sup> system.
- A mapping application shows the location of all citizen volunteers so a crisis manager can coordinate between the volunteers to maximize coverage.
- If the citizen volunteer finds something, they click a virtual button on their cellphone to change the smartphone status and trigger an update to the I<sup>3</sup> system.
- The crisis manager detects the status change and vectors law enforcement officials to the designated area.
- When the child is found, the crisis manager can issue the all clear signal to the citizen volunteers.

## I<sup>3</sup> Use Cases

**Epidemic Management:** Consider the case of an epidemic which presently relies on people reporting to the doctor sick and then asking them to account for their movements to determine the potential infected areas. What if instead people could report their illness via cellphone and tracking history could be used to identify potential areas of infection.

### Steps

- Citizens register their smartphones to the I<sup>3</sup> system as health aware volunteers
- Software on the smartphone allows the user to register their health state and other medical conditions
- Health care officials can view citizen health meters on a map in order to determine if there is heightened risk for infectious disease in a specific location.
- Health alerts can be issued for expected health concerns asking people to wash their hands more frequently.
- Severe health alerts can be triggered should it be necessary to control an epidemic situation or a bio attack.

## I<sup>3</sup> Use Cases

**Building Energy:** While environment management, lighting systems, and building security systems can be managed independently, the systems are seldom integrated but the I<sup>3</sup> system allows this to happen

### Steps

- Environmental systems (air, heat, humidity) are connected through the I<sup>3</sup> system.
- Lighting systems are connected through the I<sup>3</sup> system
- Access security (door locks) are connected through the I<sup>3</sup> system
- Motion detectors are connected through the I<sup>3</sup> system
- Local weather detectors are connected through the I<sup>3</sup> system
- The environment systems can be programmed to maintain comfortable environment throughout the day. When weather detectors find local conditions warrant, adjustments can be made to maintain comfort.
- When rooms are detected as empty, doors can autolock after hours and environmental in that room can be reduced to save energy costs.
- Lights can be turned off in unoccupied rooms and environmental can be allowed to go outside of norms until human activity is detected in the room during operating hours.

## I<sup>3</sup> Use Cases

**Smart Sanitation:** Rather than scheduling sanitation activities regardless of need, activates can be triggered on an as needed basis and directed to places in highest need

### Steps

- Garbage cans are equipped with sensors to auto report to the I<sup>3</sup> system when the cans are near capacity.
- Garbage trucks and buses are equipped with video monitors
- Street lights can monitor local areas for situations war renting attention and video images can be used to ticket repetitive litter bugs.
- Sanitation trucks are scheduled based on bins with the greatest need.
- As garbage trucks and buses make their rounds, they collect video data which is analyzed real time to identify areas in need of attention.
- Street cleaning crews are dispatched based on video data from buses and garbage trucks.
- In areas of high need, water trucks with pressure washers can be dispatched as needed for heavy duty cleaning situation.



## I<sup>3</sup> Use Cases

Smart Parking: Intelligent meters allow credit card payments and can alert authorities to violations. IOT based meters can be used to dynamically change parking prices based on level of congestion

### Steps

- Public and private parking lots are connected to IOT systems to measure the number of cars in the lot versus the number of available spaces.
- Parking lot spaces can be equipped to detect a registered citizen and auto charge their account when they park in a parking lot; sensors can also be used to detect if the car has been damaged while parked (hit or vandalized) and alert the citizen
- One the street parking meters can be used to collect parking fares as well. Registered users can skip paying the meter by auto-paying after they have been detected. Auto-payment customers can also auto-extend their parking time (within limits) to avoid having to revisit the meter. Unregistered users need to feed the meter.
- The I<sup>3</sup> system has visibility to all area parking spots and can direct people to an available space based on their location.
- The local authority can dynamically price parking prices making parking cheap during times of plenty and costly during times of scarcity in order to discourage parking congestion. The authority can also price different spaces differently in an effort to encourage parking in designated areas.

## I<sup>3</sup> Use Cases

Smart Traffic: Sensors are used to measure traffic congestion but these signals are often not integrated to maximize city management

### Steps

- Traffic sensors are built into roads where possible.
- Video cameras are placed and used to measure traffic volumes when embedded sensors are not feasible.
- These traffic sensors are used to adjust traffic light durations to slow traffic coming into congested areas.
- Speed limits are reduced in congested areas and in areas that feed into congested areas
- Speed limits and traffic light durations are extended evening hours are during times of inclement weather.
- When an emergency situation is detected requiring emergency services (police, firemen, or ambulances) traffic lights and speed limits are adjusted to reduce time to get to the scene without collateral damage.

## I<sup>3</sup> Use Cases

**Terror Pursuit:** When the Boston Marathon bombs went off, Police ended up searching the entire Boston area for signs of the terrorists, often relying on television alerts and citizen telephoned reports. Imagine how more effective the system would be if images could be sent via cellphone to people in a specific location and on sightings, take-cover instructions could be quickly and easily relayed to area residents to simplify the pursuit process.

### Steps

- Citizens register their smartphones to the I<sup>3</sup> system as neighborhood watch volunteers
- When an amber alert is issued, it triggers a program on the cellphone that provides volunteer with indicators of suspicious activity that should be monitored.
- Citizens smartphones begin transmitting their location information back to the I<sup>3</sup> system.
- A mapping application shows the location of all citizen volunteers so a crisis manager can coordinate between the volunteers.
- If the citizen volunteer finds something, they click a virtual button on their cellphone to change the smartphone status and trigger an update to the I<sup>3</sup> system.
- The I<sup>3</sup> system passes the notification alert to local law enforcement official.
- Law enforcement officials can access surveillance videos, reports from alarm system, and status indicators from other volunteers to prioritize their activities.

## I<sup>3</sup> Use Cases

**Theme Park:** Some theme parks (e.g. Disney) are beginning to use IOT to manage consumer experience when at the park. For example, magicband allows line management and reduces need for cash/credit cards. An expanded IOT implementation would allow that experience to start at home before the theme park experience and continue after the theme park when back at home or at the neighborhood mall.

### Steps

- Citizens register their magicband (or equivalent) as a beacon that is recognized by their smartphones and reported to the I<sup>3</sup> system.
- Once registered, helpful information on their trip can be sent before the trip to increase anticipation.
- At the trip, in-park sensors record and manage the consumer activity.
- Once the visitor leave the park, the system continues to report location information which can be used to trigger location based offers and time of day news

## I<sup>3</sup> Use Cases

**Crisis Direction:** Bomb alerts are thankfully rare but this means that when a bomb threat is received, people do not generally know how to react. If you know who is near the potential bomb site, you can send information to the people in the vicinity telling them how to take cover and to alert them to watch for suspicious activity turning them into extra eyes for the police.

### Steps

- Citizens register their smartphones to the I<sup>3</sup> system in order to receive civil alert notices.
- When an civil alert is issued, it triggers a message to the cellphone that provides citizens with response instructions.
- If the citizen needs additional assistance, the citizens can click an indicator button to notify authorities the severity of their distress.
- A mapping applications shows the location of all alerted citizens and the level of needed assistance so a 911-type manager can coordinate a response plan with local authorities.
- The emergency status remains in effect until the 911-type manager signals all clear.
- While the emergency is in effect, the citizen can increase or decrease their assistance indicator and the smartphone status and trigger an update to the I<sup>3</sup> system.

## I<sup>3</sup> Use Cases

**Fluids Management:** Chemical, Oil, and Gas industries are critical infrastructure covering large geographic areas where minor disruptions can have catastrophic economic and environmental impact (why they are often terrorist targets). This infrastructure must be constantly monitored for security and operational efficiency and corrective action taken when there is the slightest hint of disorder.

### Steps

- A fluid management company deploys sensors through their pipeline network and configures the sensors to report flow and fault conditions to the I<sup>3</sup> system on a periodic basis over the cellular network.
- Field personnel register with the I<sup>3</sup> system so their location can be tracked during their shift (or when they are on call)
- When a fault alarm indicating a pipeline break is detected, an alert is sent to company personnel and to civil authorities near the sensor in case a serious situation has been detected.
- When the flow indicators deviate from expected norms, an alert is sent to company personnel so the situation can be investigated further.
- If deemed necessary, the company's dispatch office can direct the nearest support team to the effected area.

## I<sup>3</sup> Use Cases

**Distributed Healthcare:** Most medical institutions are focused on improving efficiency in our large hospitals but lowering the cost of healthcare requires moving resources closest to those in need. This means more capable ambulances and more capable community healthcare centers that are coordinated among one another.

### Steps

- Doctors register with the I<sup>3</sup> system so their location can be tracked during their shift at the hospital or at their local clinic (or when they are on call)
- Ambulances are equipped with location beacons that report to the I<sup>3</sup> system via the cellular network. Ambulance beacons are equipped with a switch allowing the ambulance operators to report their current status (with patient, available, off-duty, etc)
- Medical helicopters are equipped with location beacons that report to the I<sup>3</sup> system via the cellular network. Helicopter beacons are equipped with a switch allowing the pilots to report their current status (with patient, available, off-duty, etc)
- When a 911 call comes in, the 911 dispatcher can see the status and location of any nearby ambulances, helicopters, and even doctors. They can vector emergency resources to the call site via text and voice call.

## I<sup>3</sup> Use Cases

**Food Tracking:** The food industry is a high tech and distributed ecosystem. GMO seeds and specialized fertilizers are used by a network of distributed farmers who's produce is shipped to processing centers by a network of independent truckers before the food is prepared for delivery to distribution centers and ultimately to our tables. When something goes wrong in the process it is often difficult to trace the product back to the source of the disruption but the quicker this can be accomplished and alerted to the public, the lower the impact on public health.

### Steps

- Produce/food crates are equipped with a beacon when the food leaves the farmer and the beacon is registered with an I<sup>3</sup> system.
- Beacon detectors are placed entry/access points of all distribution centers, stores, and restaurants.
- Refrigerators and refrigerated trucks/trains/etc are equipped with temperature sensors that report to the I<sup>3</sup> system
- As food moves from farm to retail store, each steps is tracked and logged by the I<sup>3</sup> system.
- When a fault in the food transportation system is detected, the I<sup>3</sup> log can be searched by the beacon identifier so each step in the supply chain can be checked and the duration at each stop validated.

## I<sup>3</sup> Use Cases

**Drone Management:** FAA has announced initial rules for drone operation, however these rules are difficult to police and impede many commercial drone applications. Ultimately these rules will need to be amended and the modifications may require IFF transponders near high traffic areas so automated ground based controllers can manage local drone traffic.

### Steps

- Commercial drones are equipped with beacon broadcast systems that report the location of the drone during any active flight. Each drone must be registered with a local I<sup>3</sup> system so its movement can be tracked.
- Drones that drift near an airplane are flagged using beacon supplied data for further investigation.
- Drones that do not carry a beacon can be shot down by drone hunter drones that might use water or nets to decommission wayward drones.

## I<sup>3</sup> Use Cases

**Senior Center:** Older adults in senior living centers often need medical nudges but do not require medical/care professionals. These units can be equipped with home monitoring devices (pill monitors, blood pressure, heart monitors, scales, and phones/computers) to monitor their healthy habits. Feedback devices can provide reminders and progress can be reported to doctors, family members, and home administrators..

### Steps

- Senior apartments in adult living centers can be fully equipped for IOT supported living
- Each IOT device in the apartment is registered to an I<sup>3</sup> system so the residents family, the local housing manager, and the supporting doctor can have access to the IOT status information.
- IOT devices include pill monitors, blood pressure monitors, heat monitors, and scales.
- The apartment is also equipped with a Raspberry based acknowledgement system which includes a text display and an audio alert.
- When the resident is scheduled to take a pill, an alert is displayed on the text screen, and an audio indication is raised until the patient hits the acknowledgement button. If the pill container is not used within a time window, the alert is re-issued.
- Residents are expected to hit the acknowledgement button on a scheduled basis (schedule varies per resident) to signify everything is in order.
- Blood pressure and heat information is relayed back to the I<sup>3</sup> system
- Computers or cellphones can be used to enter dietary information during meal times.

## I<sup>3</sup> Use Cases

**Retail Tracking:** Retail shoppers can be monitored for their browsing habits to determine where customers spend their time and lines can be monitored to ensure customers get proper service. Frequent shoppers can be identified for special care. Coupons can be delivered based on where the customer is in the store and reminders can be sent to customers if they leave and fail to make a targeted purchase.

### Steps

- Retail stores are equipped with video cameras that feed streams to the I<sup>3</sup> system for later analysis.
- Applications examine video feeds to determine where customers spend their time in the store and the patterns that are used to traverse product displays.
- Facial recognition can be used to detect frequent customers and flag these customers for high priority treatment.
- High priority customers may be targeted with coupons when they are in front of a triggering display.
- High priority customers may be targeted with a coupon if they are about to leave the store without purchasing a product that they appeared to be interested in.
- Facial recognition can be used to detect suspected criminals and alerts can be generated to draw higher than normal attention to these shoppers as possible threats.

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## I<sup>3</sup> Use Cases

**Firefight:** smoke alarms alert the fire department to a possible fire. They are able to access the local sensors to determine that a situation has arose that is more than a simple fire and they bring ambulances, SWAT team, and local health center administrators.

### Steps

- Business and residential buildings are equipped with smoke, gas, and fire detectors that report to an I<sup>3</sup> system
- Fire, police, and medical personnel register their cellphone with the I<sup>3</sup> system so dispatchers can easily locate them as needed
- When the I<sup>3</sup> system receives an alert that something is amiss, it generates an alert that can be sent to a neighbor's cellphone.
- Neighbors can check on the house and if something appears suspicious, they use their cellphone to validate the I<sup>3</sup> detected condition and summon the appropriate local authorities based on the situation.
- The I<sup>3</sup> system passes the signal to nearby fire, police, and emergency services as appropriate.
- Because neighbors are involved in the process, false alarms are reduced and because the nearest support people are contacted immediately, response times are reduced.

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## I<sup>3</sup> Use Cases

**Firewatch:** external infrared image detectors are used to identify dangerous environmental conditions that may indicate fire or a less severe but heat related condition

### Steps

- External infrared cameras are deployed throughout an area
- On a scheduled basis, the cameras take an infrared picture of the area they are targeted on
- If image analysis indicates the pictures exceed expected norms in terms of heat signature, additional queries of IOT devices are taken to clarify the situation.
- If warranted, warning messages are automatically triggered
- Image analysis may detect building fires where the fire alarms have failed, grass fires, car-fires.
- Analysis may detect heat-warnings that can be sent to schools and companies with significant outside workforces.

## I<sup>3</sup> Use Cases

**Grounds Management:** IOT device technology can be used to lower the cost of grounds management while making resource utilization more efficient.

### Steps

- Sensors are deployed on grounds to detect real-time conditions of spaces with different resource requirements
- When a grounds sensor self-detects a moisture or infestation issues an alert is generated.
- Central analytics can periodically poll local sensors to validate local conditions.
- Weather information can be integrated into the scheduling process to cancel or postpone activity when not needed.
- When action is warranted, ground maintenance activity is scheduled to optimize resource use. Possible actions include scheduling watering, infestation response activity, scheduling robotic grass cutting, snow shoveling, or weeding.