

# Internet of Things for Next-Generation Public Safety Mobile Communications

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## ABSTRACT

This short paper briefly introduces the beamCitizen, a next-generation public safety mobile communications technology. It provides a mobile cloud communication platform that allows sharing of live video, voice, text, photo, location and other critical information among citizens, dispatchers and responders. It aims to connect people, information, and sensors. Our approach was to apply and implement “Internet of Things” for development of the beamCitizen. To evaluate the beamCitizen, we used the University of Maryland as a pilot to create an end to end public safety communication and response service among the citizens, the 911 center and the first responders in order to help connect and protect close to 20000 students, faculty and visitors. It is available for download.

## Keywords

Mobile app, cloud communication, sensors, crisis response, information sharing, internet of things, public safety

## INTRODUCTION

When it comes to public safety and homeland security, everyone says their objective is to improve the speed and effectiveness of emergency response.

Cisco estimates IoE (Internet of Things) will annually generate \$19 trillion value in 2020. It is labeled as the “fourth phase in the evolution of the Internet” by Intel. Today – there are 50 billion physical objects and 99.4 percent are still unconnected. 200 billion intelligent imbedded devices will connect with other machines without human intervention by 2020. These connections can be people-to-people (P2P), machine-to-people (M2P), and machine-to-machine (M2M). IoE offers massive opportunity for innovation and growth and helps to improve the way we live, experience and protect lives. A vehicle can directly communicate type and location of an incident to save precious emergency response time. A vending machine can dispatch delivery of goods without human involvement. Merchants and public agencies can automatically deliver personalized and localized content to help people save time and money and protect people and properties.

SMS, email and existing broadband messaging services do not address the messaging, notification, and management features required by IoE for the public safety. Some challenges include:

- They cannot support multi-sensory conversation and are limited to traditional media such as text and video.
- They have unacceptable latency and cannot provide instant alerts and notifications.
- They lack adequate encryption to ensure the security of data generated from sensors.
- They do not provide simple and effective platform to collect, organize and share the diverse content generated from a wide range of sensors.

- They demand significant processing power which causes costly expenditures and inhibits the launch of new IoE services and Requirements and demands include.

Our objective is to develop a next-generation public safety mobile communication which we call the beamCitizen [2]. We aim to create an encrypted mobile cloud communication platform that connects people, information, and sensors on an unprecedented level for the homeland security and public safety domain. In this short paper, we briefly introduces this platform and its application in practice for the public safety domain.

#### APPROACH

Our objective is to develop the “dynamic omni-content page” [3]. It is designed to meet the growing demands of IoE in the public safety domain problem. The dynamic omni-content page internets everything to keep people connected and protected. Some key features include:

- Form dynamic chat rooms around event-based communities.
- Securely share a diverse amounts of content including live video, photo, voice, text, and location from a range of dynamic and distributed *sensors*.
- Instantly connect people and machines using low latency multi-sensory messaging and notification services.
- Deliver personalized and localized content to simplify the way people collect, organize and share information.
- Allows anyone to customize IoE connectivity features in a timely, cost-efficient way.

We developed the beamCitizen. The beamCitizen is based on dynamic omni-content page (Figure 1.a). The beamCitizen is considered the next-generation public safety mobile communications technology. It identifies a method of responding and a system for responding for emergency calls that will include location-based technology, video, image and audio data in addition to SMS (texting) for types of services that include at least one emergency system and emergency service (that) comprises a 911 call service (figure 1.b).

This technology is based on cloud communication to deliver location data, voice, text, video and images in seconds to first responders. Digital communication is proven to be more cost-effective and reliable than the currently used analog emergency response systems [4]. Key features of beamCitizen are as follows:

- Be an emergency communication platform that uses broadband wireless to instantly display all vital information on the same page.
- Share more than just pictures, locations, videos and audio. It broadcasts live video combined with text, GPS and content from any other digital sensor.
- Instantly share the same encrypted information with dispatchers and responders so the right hands know what the left hands are doing.
- Connect every smart device and any browser. It works with Wifi, 3G/4G LTE and is FirstNet ready.
- Complement legacy systems and requires no extensive infrastructure or training. It saves time, money, and most important, lives.
- Be a broadband emergency communication platform.
- Integrated an enhanced incident command system solution with mobile app to provide secure real-time, two-way communication to improve situational awareness and citizen safety.
- Connects citizens with 911 operators and first responders
- Be a mobile app that allows a caller with a mobile device to connect nearest first-responder network instantly.
- Support fast, efficient, and secure communications.

#### IMPLEMENTATION

Since 2011, a team of software programmers have being developing the beamCitizen. Implementation of beamCitizen mostly uses:

- .NET and C# programming languages for software development.
- Microsoft Azure for cloud computing platform & services.

- (Spatial) SQL Server for database management system.
- SQLite for implementation of a light SQL database engine on smartphones.
- Google Maps APIs for mapping.
- ASP.NET Web APIs for implementation of web services and location-based web services.
- Xamarin for mobile app development & app creation software.
- SignalR for implementation of real-time web functionality and server-client communication.

### EVALUATION AND VALIDATION

The beamSmart mobile app is available for download in [6]. Campus police at the University of Maryland Baltimore County (UMBC), is testing the beamCitizen to create an end to end public safety communication and response service among the citizens, the 911 center and the first responders to connect and protect close to 20000 students, faculty and visitors. The beamCitizen allows them to instantly communicate with multiple users via audio, video and text messages as well as geolocation functions over any device or platform [5]. UMBC force is able to get live video or audio streaming from dashboard or surveillance cameras texts, photos and location of an emergency situation; The software enhances 911 systems by providing a better picture of the scope of the crisis with real-time information so first responders can provide the best resources for that particular situation before, during and after mission-critical or 911 situations. See Figure 1.a.

### CONCLUSION

This paper introduced the beamCitizen software technology, a production of beamSmart Inc., for the public safety application. We applies the technology "Internet of Everything" for the public safety problem domain. Three future works are of important to improve the beamCitizen. 1) add a machine learning capability that looks at the prior information that was available and then makes judgments and predictive analysis, 2) empower the beamCitizen with problem-solving algorithms for action planning, task scheduling, resource allocation, decision-making, task assignment, coalition formation (Nourjou and Gelernter, 2015), 3) integrate with GIS.

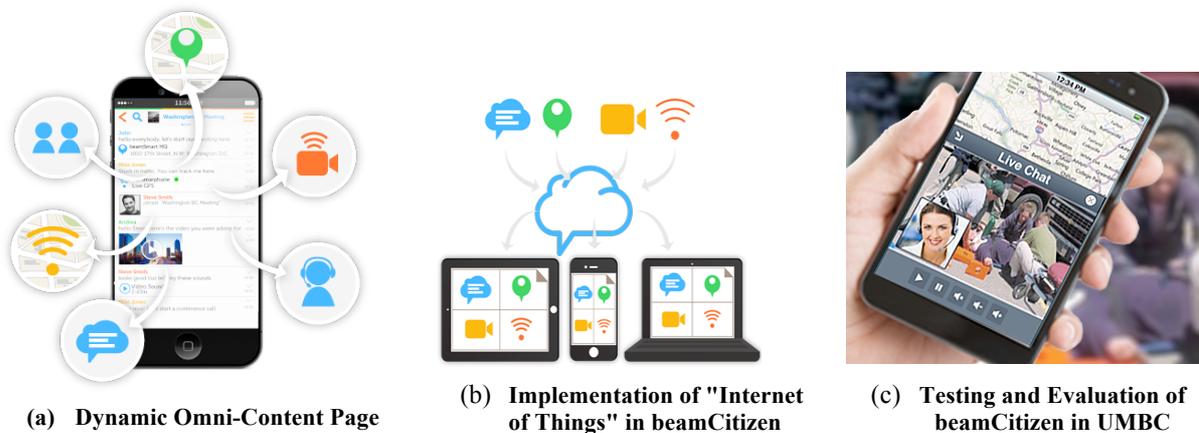


Figure 1. BeamCitizen

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