Beacon technology implementation for Human Tracking system in Oil and Gas Environment.

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ABSTRACT – The oil and gas industry confronts multiple challenges. One of the issues that it need to deals is to keep up with the frequent change of environmental regulations in monitoring and management system. In this paper, focuses are on proposing a method to remotely monitor the movement of employees performing along a distributed location in oil and gas industry. The method works by building a comprehensive floor mapping system indicating the real-time status of employees on 24/7 basis. Thus, an implementation of Beaconed system along an IoT platform will be applied for the system. Employees were given a customized beacon badge as a formal form of the ID for specific staff to be carried around. When the employee change from one location to another location, the beacon badge will transmit necessary information through the Bluetooth gateway that coordinates the collected information to a cloud-based system for floor mapping process. This proposed system are to ensure the safety of employees in the oil and gas industry when an unwanted accident occurs in their surroundings.

1. INTRODUCTION

Oil and gas industry is one of the biggest field in the economy world. The work area in this industry are divided in three section that is; upstream, midstream, and downstream [1]. On April 2010, history recorded the largest accidental oil spill in the world at Gulf Mexico. This was the major accident reported while there was accidents happening every now and then in the oil and gas industry which is always a concern for the management people especially on the safety aspect of their workers. This proves that employees in oil and gas industry do face dangerous threats when working and it is possible for such incidents to reoccur if not monitored. However the problems are not limited to just possibility of explosions, according to Occupational Safety and Health Administration (OSHA) there are many safety hazards associated within the oil and gas extraction activities such as vehicle collisions, explosion and fires, falls, confined spaces, ergonomic hazards etc.[2]. Such threats are reasons for the management team to implement a system that allows monitoring the safety and risks of workers in the surroundings of an oil and gas pipeline.

As oil and gas industry are starting to implement WSN along their pipeline[3]–[6], it is a good chance to implementing BLE communication in the network as well. The Bluetooth Low Energy (BLE) is an emerging technology in tracking as it consumes low energy while maintaining a communication range similar to the classic Bluetooth. Implementing the usage of BLE on an IOT platform help to track employee's movement while them working in a monitored area.

The IEEE 802.11 WLAN infrastructure was proposed to work on a purely software-based solution as suggested by the authors in [7]. It was tested in a multistory building as well as outdoors in which it tracks users with IEE 802.11 supported devices around the coverage of a WLAN. The devices were named as a client and it detects the signal of WAPs and sends the strength of each signal and its MAC address to WLAN Tracker periodically. Once the client location was estimated, their position will be updated on the WLAN Tracker GUI. Different environments and locations affect the result of their experiments. Another similar study was conducted on WiFi-based indoor positioning system for construction sites in Guangzhou, China. The results of their experiments showed that the positioning system was accurate within 5m area[8]. Some other related research is location tracking by smartphone sensors. Based on the study, a location tracking service was introduced by the name as SensTrack. Its purposes were to reduce the usage of GPS by leverages the sensor hints on smartphones[9]. Basically, the experiments are successful given their aim is to reduce the usage of GPS while generating accurate tracking results.

The studies mentioned above are based on wireless connection and despite its successful experiments, there are several problems especially with the technology used is not relevant to the oil and gas industry. The use of smartphones is not applicable for working in oil and gas areas where the device might trigger an explosion or fires. As an alternative, the BLE can be a good substitute that is feasible to the area of implementation. Other than that, direct signal processing through smartphones platform for indoor positioning are not quite possible and it supposed to be in conjunction with BLE[10]. Wireless sensors and wireless controls are power-constrained devices, therefore BLE can be applied as it has low power consumption. The usage of beaconed BLE is a bit different as beacon continuously sending out signal and not storing any data neither connected to the internet. Beacon's badge is acting as the physical hardware that sending out Bluetooth signal to be detected by the microcontroller in which the

microcontroller is the gateway in the system.

2. ARCHITECTURE OF TRACKING SYSTEM

To implement the man tracking device, the BLE technology was used for transmitting data in a short distance. The advantages of BLE as compared to a classic Bluetooth is that it consumes low energy while maintaining the same communication range as the classic Bluetooth. The overview of the project implementation is as shown in Figure 1.
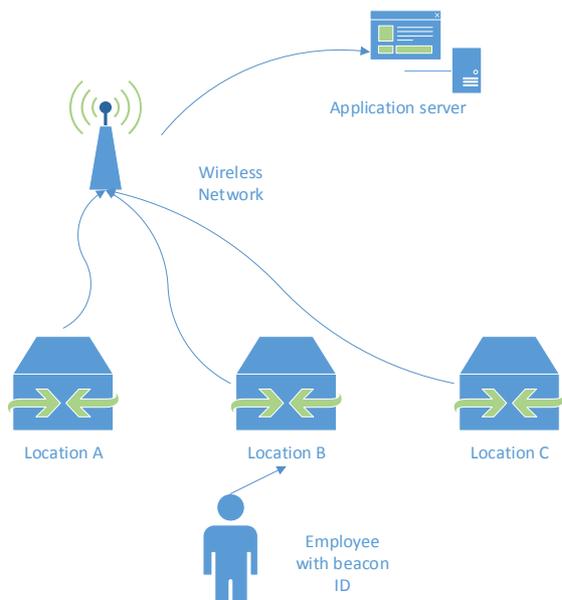

Figure 1: Process of tracking system using BLE

As in figure 1, an employee with its assigned beacon's ID are in area B. The beacon badge the employee carries are continuously transmitting a Bluetooth signal while the gateway located in location B detecting and listening to the signal. It then, sends the collected data via a wireless network to application server to show the position of the employee. As the employee move from location B to Location A or C, gateway in the respective region are acting the same as the gateway in location B. However, the connection are made only once at a time.

In this system, the use of BLE; manufactured from Kontakt.io; is proposed. The beacon transmits a UUID, a major and a minor value. These beacons use a Nordic chipset and are powered by 1000mAh, CR2477 coin cell battery. The Tx power of beacon can be configured during manufacturing to cover transmission range up to 90-meters.

3. SUMMARY

The use of wireless technology is the best solution in providing remote monitoring of workers in the oil and gas industry as proposed in this research. The requirement for monitoring was original to meet regulatory and productions demand but now it's an essential tool that keeps track of the movement of workers on real-time basis. The proposed system with the implementation of BLE technology for man tracking

in oil and gas industry will be the best choice as the features are in line with the low power and detection range. The proposed system is designed with a BLE tracking system as it transmits Bluetooth signal 24/7 while maintaining low power consumption throughout its operation.

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