Information Transmitter Using Bluetooth Energy Beacons

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***Abstract*--- Beacons are small devices that broadcast a Bluetooth smart radio signal to trigger alerts or messages on consumer phones. The next version of GPS. Instead of using satellites to triangulate your position as GPS does, beacons transmit a low energy signal to provide location. Beacons are compatible with smart phones globally and nearly all i-phones and android v4.3. It makes sense for retailers to open up their beacons so that outside apps can use them to send alerts and notifications to their users. Beacons can help retailers attract users to their apps. The transmitters use Bluetooth wireless technology to sense your exact location. That's not possible with GPS, which don't well indoors and aren't good at distinguishing between locations that are just a few feet apart.**

***Keywords*— GPS, Bluetooth, Beacons, Smart phones**

I. INTRODUCTION

As the name says "Beacon", they transmit packets of data in regular intervals of time, and this data can be picked up by devices like smart phones or tablets. These are tiny low-cost hardware which are small enough to attach to any surface be it a wall, door or any indoor area, they use battery friendly, low-energy Bluetooth connections to transmit their messages. Beacons are pretty platform independent. Earlier Apple did come out with I-Beacon protocol. You can have various different layouts from different manufacturers. The I-Beacon is proprietary to Apple, but that doesn't mean that Android devices and other devices cannot see those beacons. We're heading towards other types of packet layouts being available like Alt-Beacon and Eddy stone.

Fig .1 Bluetooth process

In a nutshell beacons and beacons' are not really just for Apple devices; you can use them across any platform, which make them really significant. There is something called received signal strength which is the line of sight from the device's Bluetooth antenna to the beacon. The disadvantage in IOS, is that it only works in the foreground. We cannot do ranging and distances when the app is in the background. So, when the screen is off it very difficult to determine location. Even when the screen is on, it can be a bit unreliable. There will be a jitter that it will think you're immediate, far, within short range, and it moves around. Hence it shouldn't be used for accurate targeting. But this can be achieved using multiple beacons. Consider beacons over your location, adjust the antenna power of each beacon to suit individual use case. You can tune the Transmission Power of your beacons at different ranges. When you get an entry for a particular beacon, that's when you deliver the push notification or that's when you take that event in and produce the action. By this way approximate distance can be found.

II. ARDUINO

The Arduino Uno R3 is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2(Atmega8U2 up to version R2) programmed as a USB-to-serial converter.Revision 2 of the Uno board (A000046) has a resistor pulling the 8U2 HWB line to ground, making it easier to put into DFU mode.

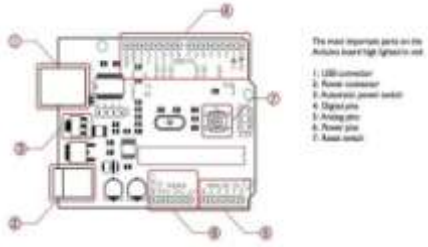

Fig .2 Arduino pin configuration

III. LIQUID CRYSTAL DISPLAY

A liquid crystal display (LCD) is a flat panel display, electronic visual display, or video display that uses the light modulating properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements. LCDs are used in a wide range of applications including computer monitors, televisions, instrument panels, aircraft cockpit displays, and signage. They are common in consumer devices such as video players, gaming devices, clocks, watches, calculators, and telephones, and have replaced cathode ray tube (CRT) displays in most applications. They are available in a wider range of screen sizes than CRT and plasma displays, and since they do not use phosphors, they do not suffer image burn-in. LCDs are, however, susceptible to image persistence.

Fig .3 Display

IV. INPUT AND OUTPUT

Each of the 14 digital pins on the Uno can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kOhms. In addition, some pins have specialized functions:

Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip .

External Interrupts: 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attach Interrupt() function for details.

PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analog Write () function.
SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication, which, although provided by the underlying hardware, is not currently included in the Arduino language.

LED: 13. There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.

The Uno has 6 analog inputs, each of which provide 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the analog Reference() function. Additionally, some pins have specialized functionality:

I 2C: 4 (SDA) and 5 (SCL). Support I2C (TWI) communication using the Wire library. There are a couple of other pins on the board:

AREF. Reference voltage for the analog inputs. Used with analog Reference(). •

Reset. Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

V. BLUETOOTH LOW ENERGY

Bluetooth low energy (Bluetooth LE, BLE, marketed as Bluetooth Smart) is a wireless personal area network technology designed and marketed by the Bluetooth Special Interest Group aimed at novel applications in the healthcare, fitness, beacons, security, and home entertainment industries.Compared to Classic Bluetooth, Bluetooth Smart is intended to provide considerably reduced power consumption and cost while maintaining a similar communication range.

Bluetooth Smart was originally introduced under the name Wibree by Nokia in 2006. It was merged into the main Bluetooth standard in 2010 with the adoption of the Bluetooth Core Specification Version 4.0.Mobile opearing system including iOS, Android, WindowsPhone and Black Berry, as well as OS X, Linux, and Windows 8, natively support Bluetooth Smart. The Bluetooth SIG predicts that by 2018 more than 90 percent of Bluetooth-enabled smartphones will support Bluetooth Smart.

Fig .4 Bluetooth Smart Ready

All Bluetooth Smart devices use the Generic Attribute Profile (GATT). The application programming interface offered by a Bluetooth Smart aware operating system will typically be based around GATT concepts. GATT has the following terminology:

Client

A device that initiates GATT commands and requests, and accepts responses, for example a computer or Smartphone.

Server

A device that receives GATT commands and requests, and returns responses, for example a temperature sensor.

Characteristic

A data value transferred between client and server, for example the current battery voltage.

Service

A collection of related characteristics, which operate together to perform a particular function. For instance, the Health Thermometer service includes characteristics for a temperature measurement value, and a time interval between measurements.

Descriptor

A descriptor provides additional information about a characteristic. For instance, a temperature value characteristic may have an indication of its units (e.g. Celsius), and the Maximum and minimum values which the sensor can measure. Descriptors are optional - each characteristic can have any number of descriptors.

VI. CONCLUSION

With this work we aimed at evaluating the possibility of using i-Beacon on Android devices as a suitable technology for the retailers to open up their beacons so that outside apps can use them to send alerts and notifications to their users. Beacons can help retailers attract users to their apps. The paper has shown the major challenges in using such technology on the proposed architecture: a big effort has been put in the signal stabilization, on the classification algorithms and on the energy efficiency on the mobile device used to sense the environment. On the classification algorithms side, we have increased the accuracy from 84% to 94%. On the application energy efficiency, proposing an alternative communication pattern via Bluetooth, we obtained a 15% improvement. We believe this is a good starting point for further developments on the different components of the proposed solution. In particular, signal accuracy is variable, but this would require a modification to the Android kernel to provide more samples and achieve the same level of accuracy of the IOS devices. Google announced the release of Android OS that promises to correct some of the bugs related to Bluetooth present in Android 4.4 and permits to generate beacon packets from the device. With this new support more solutions become possible, with an improvement of the information provided by the devices.

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