

## Security System using Bluetooth Low Energy

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**Abstract**— Security of family and assets is of prime importance to people today. People are away from home for many reasons and purposes like for jobs, vacations etc. and while they are away they are always worried about the security of their family and belongings back home. Thus the need for a coherent security system prevails in the society. Our paper discusses a security system consisting of an electronic door which uses the BLE technology. The electronic door system which we propose operates with the help of a mobile application compatible with Bluetooth Low Energy (BLE). The main motive of proposing this system is to provide a robust and reliable security system along with easy surveillance methods.

**Keywords**- BLE, Electronic Door, Mobile Application, PIR Sensor, PSoC.

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### I. INTRODUCTION

With the number of thefts and security issues burgeoning, the need for an efficient security system has increased. People working in offices, vacationing, travelling are far away from their homes and always are concerned about the security of their property and children.

But the security system must be robust and efficient unlike the traditional lock-and-key system and the surveillance system should be affordable too. These qualities of security system can be achieved by using BLE. BLE technology also known as Bluetooth Smart is an energy efficient technology thus proving to be useful and compatible in various applications. Adding to its benefits is its low cost, gaining it demand in the market.

In this paper we evaluate the BLE technology giving its specifications, requirements and applications with respect to security systems. We also shed light on the PSoC controller which can be interfaced with BLE thus providing it with a multifunctional platform. We present this system hoping that it will be able to help society tackle security related issues.

### II. LITERATURE SURVEY

The security needs felt by the society today are fulfilled by the existing systems in many different ways as per the customer requirement. The present systems present various options few of which are also self-monitored.

#### A. Present Security Measures<sup>[1]</sup>

##### 1) Contact Windows and Door:

This form of security system involves installation of security contacts at all doors and windows of the place to be secured. It is an easy and reliable form of security. When this system is activated any attempt to open the doors or windows triggers an alarm.

##### 2) Motion Detectors:

These have applications in security systems where intruders are to be detected. These can be placed in premises where lurking of humans or animals as pets is to be restricted. They come handy as they can be activated and deactivated as per ones requirement. Thus saving energy and avoiding unnecessary alarm when authorized personnel visit the secured premises.

##### 3) Control Panels:

Remote access to security systems is vital. Thus installing appropriate control panels all over the site enables user to access the system from any part of the secured area. Keeping the master panel at a place which is hard to reach for the attacker becomes essential. Most of the panels have been installed with a two ways intercom which facilitates talks with company's security monitoring point. It means is that if the security measures get activated, one can communicate with a security specialist to elaborate the exact situation. This form of open communication systems provides help faster or helps inform the security officer in-charge of the security system if it has been engaged accidentally.

##### 4) Closed Circuit TV:

CCTVs are commonly known as surveillance cameras. These are the most common and widely used security measures. These find applications in places like security against intruders, thefts, supervision in exam halls, surveillance of important artifacts in museums or stores etc. Installing digital cameras inside these areas can lessen the number of hiding places that an attacker can hide in, as well as discourage customers and employees from larceny or various inapt behaviors. This becomes a superior form of security service, and with self-integrated alarms and camera system monitoring services, one can be assured that a suspicious activity is reported and dealt with quickly.

Also the surveillance recorded from such cameras can be used as evidence for any further actions against any of the crime recorded.

**B. Required Hardware and Software Tools**

**1) Bluetooth Low Energy<sup>[2]</sup>:**

BLE marketed as Bluetooth Smart was initially launched as Bluetooth 4.0 Core Specification. BLE can be called a smaller, highly optimized version of classic Bluetooth but it actually has a complete different lineage and design goals. Unlike classic Bluetooth, BLE was designed to serve as an extensible framework to exchange data.

BLE focuses on short range communications. The range of wireless devices depends upon a variety of factors like operating environment, antenna design, enclosure, device orientation etc. Transmit power of BLE is usually configurable over a certain range which is usually between -30 and 0 dBm, but the higher the transmit power, the more demands are placed on the battery, reducing the usable lifetime of the battery cell(s). A BLE device can reliably transmit data 30 meters or more line-of-sight, but a typical operating range is closer to 2 to 5 meters to save battery life without the transmission distance becoming a nuisance to the end user. A BLE device can communicate in two ways: broadcasting or connections.

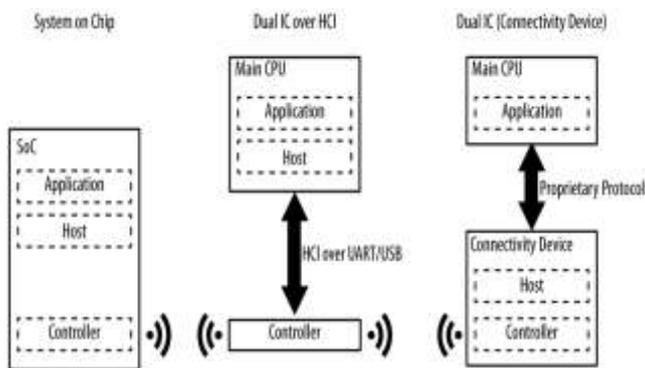


Figure 2. Hardware Configurations of BLE

**Parameters of BLE<sup>[5]</sup>:**

- Operating band: BLE operates in the  $2.4 \times 10^9$  Hz ISM band
- Coverage area : >100 m (330ft)
- Connection time:  $6 \times 10^{-3}$  sec
- Current consumption:  $< 15 \times 10^{-3}$  A
- Power Consumption: 0.1 W to 0.5 W

**2) PSoC Controller:**

PSoC is a programmable embedded System-on-Chip. It integrates components like MCU core, high-performance Programmable Analog blocks, PLD-based programmable Digital blocks, Programmable interconnect and routing and CapSense. PSoC offers sophisticated 32-bit ARM which is based on 8-bit 8051 based CPU subsystems<sup>[3]</sup>.

The CPU systems consist of SRAM, EEPROM and Flash memory, multiple core options and the following essential system resources:

- Internal low-speed oscillator.
- External crystal oscillator for precision.
- Programmable clock.
- Watch dog and sleep timers.
- Multiple clock sources including PLL.



Figure 3. PSoC BLE<sup>[6]</sup>

**3) Motion Sensor:**

Various types of motion sensors are available in the market. We are using a Passive Infrared (PIR) sensor to sense movement. They find application in burglar alarms and automatically-activated lighting systems. PIRs as they are commonly known are also called "PID" for "passive infrared detector".<sup>[3]</sup>

A PIR sensor detects changes in the amount of infrared radiation incident upon it. This incident infrared radiation varies depending on the temperature and the surface characteristics of the objects in front of the sensor. When an object, such as a human, passes against a background, the temperature at that point in the sensor's scope of view rises from room temperature to a higher temperature, the body temperature in the case considered. This temperature then returns to room temperature again as the human passes by. The sensor then converts the resulting change in the incident infrared radiation to a change in the output voltage. This change in voltage triggers the detection. Objects having similar temperature but different surface characteristics have different infrared emission patterns and thus moving these objects with respect to the background may trigger the detector as well.

**III. PROPOSED SYSTEM**

The security system which we have proposed uses BLE technology. In our system we have a motion sensor interfaced to the PSoC BLE. When motion is detected on the front side of the BLE device it starts broadcasting a message, asking user to enter the password on the mobile application.

When no motion is detected it will not broadcast any message thus saving power. When the message asking for password is broadcasted and if controller does not get reply in 3 minutes

then BLE controller will stop broadcasting the message and identify person in front of door as a visitor and display message as “ SORRY MASTER IS NOT HOME PLEASE COME BACK LATER ”. If user enters password within 3 minutes then the controller will verify the password and if password is correct then it will unlock the door. If password is incorrect then it will inform the owner through his twitter account sending him a message saying “SOMEONE IS TRYING TO BREAK INTO HOME” and will activate additional locking system to prevent unidentified person from entering into the house.

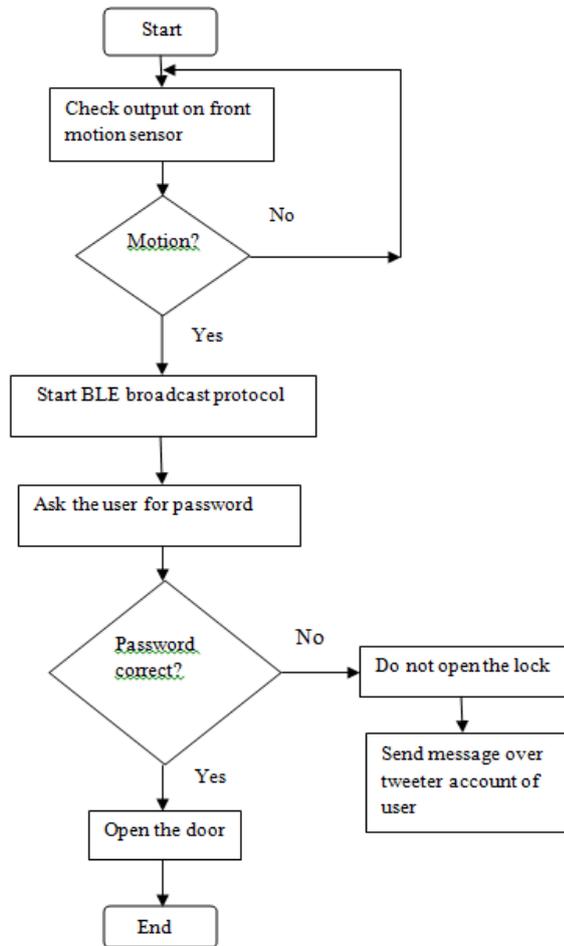


Figure 3. Flow Chart of Proposed Security System

#### IV. CONCLUSION

Bluetooth and BLE are already present in the mobile phones and tablets which we carry along with us every day so it becomes easy for us to use them for security of our houses, by controlling the locking system using the BLE interface. BLE can talk to any modern mobile platform using chips, tools, and standards that are easy to access. BLE has gone further faster because the large growth in smart phones, tablets, and mobile computing. Also mobile and tablet application which can be used to access the BLE peripheral can be easily developed for both Android and iOS.

Further BLE encryption and authentication is done by using 128-bit Advanced Encryption System (AES-128) so that it is more secure and password cannot be known to the unauthorized users. Due to its dual mode capability it can be used along with mobile phones and tablets which use the old classic Bluetooth.

Normally BLE remains in sleep mode constantly except when a connection is initiated hence there is no wastage of power when the BLE is not in use. BLE current and power consumption is less hence it can used to improve the battery life. Also connection time required for a BLE to connect to the peripheral device is less as compare to the classical Bluetooth hence it can operate at high speed.

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