

# An IoT based Smart Locker using BLE Technology

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**Abstract**— Nowadays, several smart lock systems use Bluetooth Low Energy (BLE) to establish a wireless communication between the physical key (key fob, card, smartphone, etc.) and the lock. Security is based on creating and storing secret digital keys to establish a cryptographically secure communication. The problem is that several attacks can break such security, particularly the copy of the physical key. In order to increase the difficulty of the attacks, the physical keys not store the secret cryptographic keys but reconstruct them when they are needed and remove them when they are not used. Only the trusted physical keys are able to reconstruct the secrets with the public data stored in them. This is possible by using the start-up values of the SRAM in the BLE chip of the physical key, which acts as a physical unclonable function (PUF), so that if the physical key is copied, the lock cannot be opened.

**Keywords**—Bluetooth Low Energy, Physical unclonable functions(PUFs), Security applications, Electronic systems on chip.

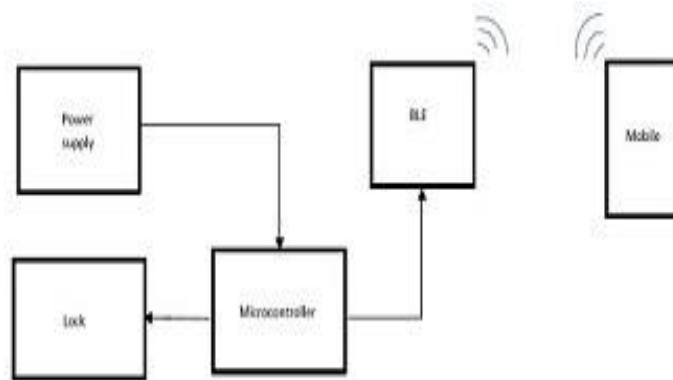
## I. INTRODUCTION

The internet of things has been rumored to be the next big thing. The internet of things is a network of physical objects embedded with electronics that enable them to collect and exchange data. The application of these devices often make our live much easier, but with the rapid development of these instruments we often overlook security. As we start increasing the connectivity of physical devices they often become susceptible to breaches in security. With the development of new IoT devices security is often overlooked and this makes these devices especially vulnerable. Security firms like Kaspersky have shown the vulnerabilities in systems like smart homes, baby monitors, car washes and police surveillance systems. Whether a hacker wants to wash their car free of charge, or stalk someone via their fitness tracker IoT security flaws make it possible. Wind River published a white paper on IoT security in January 2015 and one of their main points was that it's an unrealistic expectation that it is somehow possible to compress 25 years of security evolution into novel IoT devices. Despite glaring and gaping holes in many IoT devices they continue to be released, and the world that we are living in has continued to become more connected. For instance, as recently as May 2016 it has been released that computer scientists at University of Michigan have discovered vulnerabilities in Samsung's Smart Home automation system

that allowed them to carry out a host of remote attacks, including digitally picking connected locks from anywhere in the world. Samsung's SmartThings system is one of the leading Internet of Things platforms for smart homes and the researchers discovered that the attacks were made possible due to two intrinsic design flaws that are not easily fixed. Information such as this forces us consumers to think twice before using systems such as this to connect locks and other security-critical devices. Sadly many people don't think twice because as time goes on we are becoming more and more conditioned to trust technology.

## II. PROBLEM DEFINITION

The major problems for everyone about the locker are sometimes we forgot to lock the door back or sometimes we did not know that we lock the locker or not. So we have to go back to check for sure or leave it and risk of losing important stuff. Furthermore, Key losing is also the most common problem for people. An IoT based smart employee locker with wireless connectivity along with an android application that helps employee to unlock locker using Android application. The proposed system has a smart employee locker that unlocks when employee unlock using Android application.



SYSTEM ARCHITECTURE

#### A. Locker

It is solid material made by iron which is used to store various things( confidential data, personal document, jewellery, etc.) locker containing separate three compartment for storing purpose.

#### B. Microcontroller

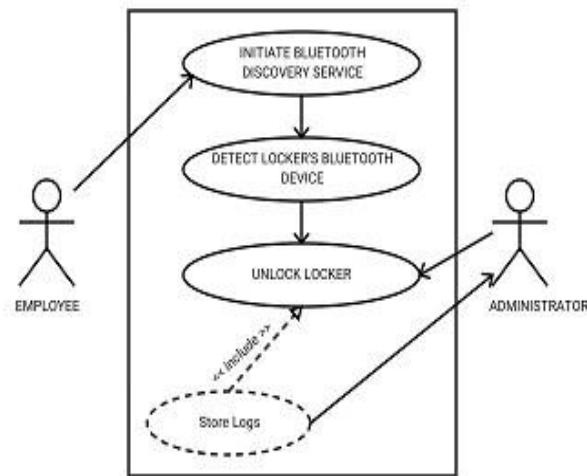
A microcontroller is a small computer on a single integrated circuit. In modern terminology, it is similar to, but less sophisticated than, a system on a chip (SoC); an SoC may include a microcontroller as one of its components. A microcontroller contains one or more CPUs (processor cores) along with memory and programmable input/output peripherals. Program memory in the form of ferroelectric RAM, NOR flash or OTP ROM is also often included on chip, as well as a small amount of RAM. Microcontrollers are designed for embedded applications, in contrast to the microprocessors used in personal computers or other general purpose applications consisting of various discrete chips. Microcontrollers are used in automatically controlled products and devices, such as automobile engine control systems, implantable medical devices, remote controls, office machines, appliances, power tools, toys and other embedded systems.

#### C. BLE

Bluetooth Low Energy (Bluetooth LE, colloquially BLE, formerly marketed as Bluetooth Smart) is a wireless personal area network technology designed and marketed by the Bluetooth Special Interest Group (Bluetooth SIG) aimed at novel applications in the healthcare, fitness, beacons security, and home entertainment industries. Compared to Classic Bluetooth, Bluetooth Low Energy is intended to provide considerably reduced power consumption and cost while maintaining a similar communication range. Mobile operating systems including iOS, Android, Windows Phone and BlackBerry, as well as macOS, Linux, Windows 8 and Windows 10, natively support Bluetooth Low Energy. The Bluetooth SIG predicts that by 2018 more than 90 percent of Bluetooth-enabled smartphones will support Bluetooth Low Energy.

#### D. Android Smartphone

A smartphone is a physical device is a class of mobile phone and mobile computing device. They are distinguished from feature phones by their stronger hardware capabilities and extensive mobile operating systems. Android is a mobile operating system developed by Google, based on a modified version of the Linux kernel and other open source software and designed primarily for touchscreen mobile devices such as smartphones and tablets.



### III. DATA FLOW DIAGRAM

- A data flow diagram (DFD) is a graphical representation of the "flow" of data through an information system, modelling its process aspects. A DFD is often used as a preliminary step to create an overview of the system without going into great detail, which can later be elaborated. DFDs can also be used for the visualization of data processing (structured design)
- Employee is actual end user which can access locker by using BLE Locker system.
- Employee will initiate Bluetooth Discovery Service.
- After discovery phase Employee will detect locker Bluetooth device with the help of his/her android smart phone.
- Now employee will try to unlock locker with his/her device.
- When employee gives command to open the locker. These commands store in the form of Logs on the cloud system, now the cloud will send these logs to the administrator for checking validation of employee.
- After checking the authentication of the employee administrator will give command to unlock or do not unlock for that employee.

### IV. CONCLUSION

After studying we conclude that smart employee lockers has following benefits:

- Save time money (maintenance staff, battery replacements, etc.)
- User-friendly use of lockers (card, mobile phone as key)
- Clean-line locker banks (Fully concealed locks)
- Easy Complete locker management (with various reports)

A complete smart lock open-source system is implemented on a ESP32 Microcontroller board. This means that system administrators can access the web server running on the board itself, and the users can enter codes that are validated by onboard software too. Authors provide a step-by-step guide to install and test the system. Besides, developers around the world can extend and modify the available source code with minimum complexity. Although this is the first available version of the proposed system, its architecture enables modular development, management, automation, and eases updating and maintenance by means of stable, professional, and widely accepted software tools.

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#### REFERENCE

- [1] Gyanendra K Verma, Pawan Tripathi , “A Digital Security System with Door Lock System Using RFID Technology,” Year 2010.
- [2] Mr. Lokesh M. Giripunje , Suchita Sudke , Pradnya Wadkar, Krishna Ambure, “IOT Based Smart Bank Locker Security System,” Year 2017.
- [3] Srivatsan Sridharan, “Authenticated secure bio-metric based access to the bank safety lockers,” Year 2014.
- [4] G. Mierzejewski , J.D. Enderle, “Remote control locker,” Proceedings of the IEEE 26th Annual Northeast Bioengineering Conference (Cat. No.00CH37114) , Year 2000.
- [5] Donhee Han , Hongjin Kim , Juwook Jang, “Blockchain based smart door lock system,” Year 2017.
- [6] Matias Presso , Diego Scafati , Jos Marone, “Design of a Smart Lock on the Galileo Board,” Year 2006.
- [7] Bhalekar Panduram , Jamgaonkar Dhanesh , Prof. Mrs. Shailaja Pede , Ghangale Akshay , Garge Rahul, “ Smart Lock : A Locking System Using Bluetooth Technology Camera Verification,” Year 2016.