



Low Energy Smart Lighting System using IoT and Bluetooth

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Abstract:

The exploration and usage of keen lighting framework are getting more famous on the grounds that the Internet of Things holds the capacity for making individuals think more astute through remote advancements. The establishment of frameworks in view of remote systems can assume a key part towards brilliant lighting framework. This work proposes a smart color lighting mechanism for controlling the data via cloud services in the field of low energy bluetooth based network. By using bluetooth low energy and android, user can upload the data to cloud services to control the color of the lighting system in industries, restaurants and home. Reenactment comes about demonstrate that the proposed arrangement is adaptable and helpful for the end clients. Wireless technology has shown continued growth over the last few years. Android, bluetooth low energy and cloud technologies are used for Smart Lighting System.

Keywords: Android, Bluetooth, BLE, Cloud, GAP, GATT, LED, IoT, PSoc

I. INTRODUCTION

Lighting assumes an essential part in everyday living. Lighting profoundly affects our state of mind, wellbeing, profitability and solace. Light emitting diodes are low-cost and energy-efficient [14]. Lighting is turning into the ideal setting for the Internet of Things for various reasons. The first is the quick worldwide move to the LED innovation [12]. Light Emitting Diode presented a noteworthy change in the quality, productivity and life span of light sources; however it has additionally permitted the incorporation of computerized advances into lighting. Being computerized gadgets themselves, LED's are naturally good with remote correspondence advances and keen lighting controls. We trust that keen advances will on a very basic level change the plan of action of the lighting business and constrain all genuine market members to join the greatest revolution. Internet of Things is a new revolution which has unique identities and is connected to the Internet. Specialists conjecture that by the year 2020 there will be a sum of 50 billion gadgets associated with the Internet. Significant industry players are energized by the outline of new markets for their items. Internet of Things and Cloud computing are in demand for IT industries to increase the profits on the investments for software infrastructure and development [3].

A cloud service is a resource provided over internet making it accessible for the end user for effective management of data in the smart lighting system. Cloud administrations like SaaS offer high adaptability, which gives clients the choice to get to additional, or less, administrations or components on-request. Google docs are used to store and retrieve the data from Cloud. Google doc acts as SaaS which provides the users to save and fetch the data from the storage resources. Google Docs is accessible for some record sorts, for example, Documents, Spreadsheets, Presentations, Drawings and Web Forms. At the point when end client works in remote zones, Google Docs lets all of you cooperate on single archives in the meantime. Google Apps coordinates with several Apps to broaden usefulness and enhances joint effort.

II. LITERATURE SURVEY

Bluetooth low vitality is a remote and economical which can be utilized when going with your portable workstation or different remote gadgets, you'll at no time in the future need to stress over bringing association links [1]. Bluetooth doesn't have you set up an association or push any catches. Whenever at least two gadgets enter a scope of up to 30 feet of each other, they will consequently start to impart without you doing anything. Bluetooth is institutionalized remote, implying that an abnormal state of similarity among gadgets is ensured. Bluetooth will interface gadgets to each other, regardless of the possibility that they aren't a similar model [5]. Therefore of Bluetooth utilizing low power flags, the innovation requires almost no vitality and will utilize less battery or electrical power thus. This is a brilliant advantage for mobile devices, as Bluetooth won't deplete the battery. Android is a versatile working framework in light of the Linux piece and now created by Google. Android is essentially intended for touch mobile devices like smartphone, table PCs, and particular UI for Android TV, android empowered vehicles, and android wear [15]. The greatest preferred standpoint of the Android is Google. Android working framework is possessed by Google. Google is a standout amongst the most trusted and presumed item on the web. The name Google gives loads of trust to the clients to purchase Android gadget. The best piece of the Android is the accessibility of a great many applications [2]. Google Play store is accounted for as world's biggest versatile store. It has practically everything from films to recreations and a great deal more. These things can be effectively downloaded and gotten to through Android phone. Cloud administrations are dependable in light of the fact that most suppliers offer a Service Level Agreement which ensures day in and day out/365 and 99.99% accessibility. Your association can profit by a gigantic pool of excess IT assets, and also speedy failover component - if a server comes up short, facilitated applications and administrations can undoubtedly be traveled to any of the accessible servers. The execution of the proposed BLE based remote system situation is approved as far as better interoperability and decreased multifaceted nature.

Lighting assumes an imperative part in our lives. Lighting profoundly affects our state of mind, wellbeing, efficiency and solace. Lighting is turning into the ideal setting for Internet of Things for various reasons. In a typical scenario, if a user need to change the color of the lighting, change in hardware is mandatory wherein I need to replace the bulb each time to get the desired color. If I need 10 different colors for the lighting, 10 bulbs are required to get the desired color by replacing the bulb. Controlling lights with Smartphone via Bluetooth is already available in market. One of the principle downside, in the event that if a user has to set the information for controlling the light sitting in different location, it's not achievable

III. BACKGROUND

Smart bulbs can wirelessly connect with smartphone applications. Some shrewd knobs, for example, the Belkin WeMo LED and GE Link Bulbs, have booking highlights which let you control your lights when you aren't home. Many brilliant knobs additionally change color of light. Actually, a few, including the Flux Smart LED Light Bulb, can create a scope of more than 16 million hues. Client can choose the correct shading they need by tapping a shading wheel in the mobile application. User need to change the color of bulb, if they need a warm atmosphere in the room. For example change light color to a golden yellow to have warm atmosphere. On the off chance that the client wishes to have chilly air in room, at that point they can change the color to light blue. Amid gatherings client can coordinate the topic's shading with the lighting. Amid Christmas or occasions client can turn the brilliant color light to red and green. Envision not having speaker wires all over the place, but rather as yet having the capacity to hear most loved tunes in any room of the house. Keen knobs with implicit speakers can get it going. Play knob shading has lights that throb and change hues to coordinate the state of mind of the music leaving it speakers. One of the disadvantage with play globule is music does not sound uproarious. Client truly can't hear it, on the off chance that they are strolling from space to room. Keen globules can even help the general population to rest better. The C Sleep discharges a few shade temperatures that are intended to help control common melatonin generation in the body. Light settings help stifle human melatonin levels amid the day and increment melatonin as the clients tend towards the sleep time.

IV. MOTIVATION

The fundamental inspiration of this work is to give the solace feeling to end client to change the color of LED bulb by sitting in different location. The market for applications utilizing Bluetooth Low Energy is always developing. The Bluetooth SIG expects that by the year 2018, more than 90 percent of all Bluetooth empowered gadgets will bolster Bluetooth Low Energy [8]. As more cell phones pick up support for Bluetooth Low Energy, the conceivable outcomes of utilizing the technology for new sorts of use increments. IoT organizations in future are relied upon to utilize ultra low power and short range communication gadgets [9]. One of the fundamental components of Bluetooth Low Energy is the low power utilization [11]. Actualized application is intended to run constantly in the closer view.

V. SYSTEM ARCHITECTURE

The proposed solution for low energy smart lighting system uses cloud based environment to set and get the data for

lighting system. The solution consists of device programming, mobile to device connectivity and obtains data from cloud services to set and get the desired color of the lighting system in bulb. Bluetooth Low Energy (BLE) is a full-highlighted, layered, correspondence convention that incorporates a 2.4-GHz radio, a connection layer, and an application layer [10]. We will utilize programming devices Programmable System-on-Chip (PSoC) Creator to create and troubleshoot your BLE extend. PSoC Creator is Cypress' standard incorporated plan condition. The BLE convention has been preoccupied into a simple intuitive BLE Component in PSoC Creator. PSoC Creator causes you design and program simple and advanced fringe usefulness into a Cypress PSoC gadget. Utilizing PSoC Creator, you can choose and put segments, compose C and additionally Assembly source, and investigate and program the venture/part. At the point when utilized with related equipment, this dynamic equipment programming mix enables you to test the venture in an equipment domain while seeing and investigating gadget action in a product situation. Google Docs is a free Web-based application in which reports and spreadsheets can be made, altered and put away on the web. Documents can be gotten to from any PC with an Internet association and a full-highlighted Web program. Google Docs is a piece of a complete bundle of online applications offered by and related with Google. To build an android application four application components such as activities, services, broadcast receivers and client providers are used [4]. Activities manage the UI and handle the client cooperation to the advanced smartphone screen. Services handle foundation preparing related with an application. Broadcast receivers handle correspondence between Android OS and applications. Content providers handle information and database administration issues.



Figure. 1. System Architecture

VI. USE CASE DIAGRAM

Use cases represent the system functionality; the requirements of the system form the end user perspective. Use case diagram normally displays the basic flow, alternate flow and exception flow in the system. Use case diagrams are typically alluded to as conduct outlines which are utilized to depict an arrangement of activities that some framework ought to perform in a joint effort with at least one outside clients of the framework. The major purpose behind UML is to address a graphical blueprint

of the handiness given by a system to the extent on-screen characters, their targets and any between conditions between the use cases.

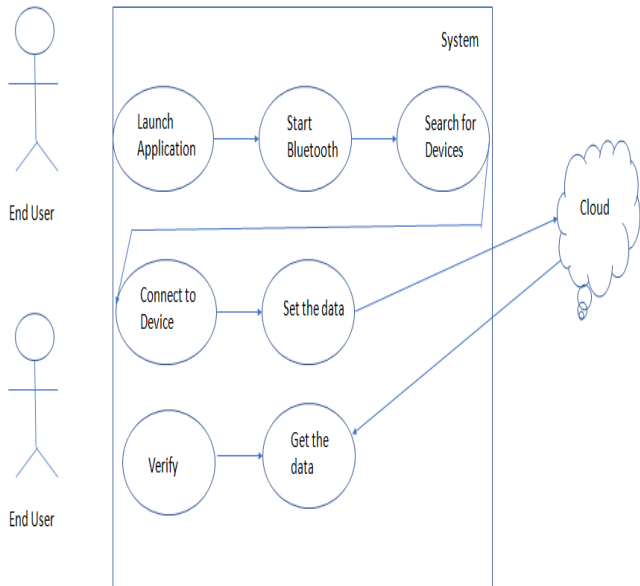


Figure. 2. Use Case Diagram

VII. SEQUENCE DIAGRAM

Sequence diagram is a connection outline that shows how objects work with each other and in what order. The succession outline demonstrates the grouping of occasions in the framework when the versatile application is propelled. It depicts the object interactions in a given scenario identified for a BLE device to scan and obtain its characteristics. To store and retrieve the data from cloud google docs is used.

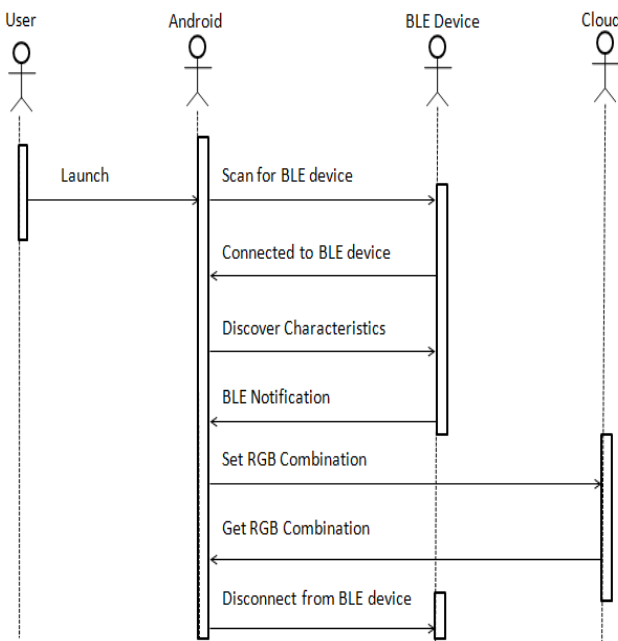


Figure. 3. Sequence Diagram

VIII. SYSTEM FLOWCHART

The below Figure 4 depicts the flow of the processes involved in the project which helps to visualize how the program work. This acts a blueprint for the developer to write or build the program.

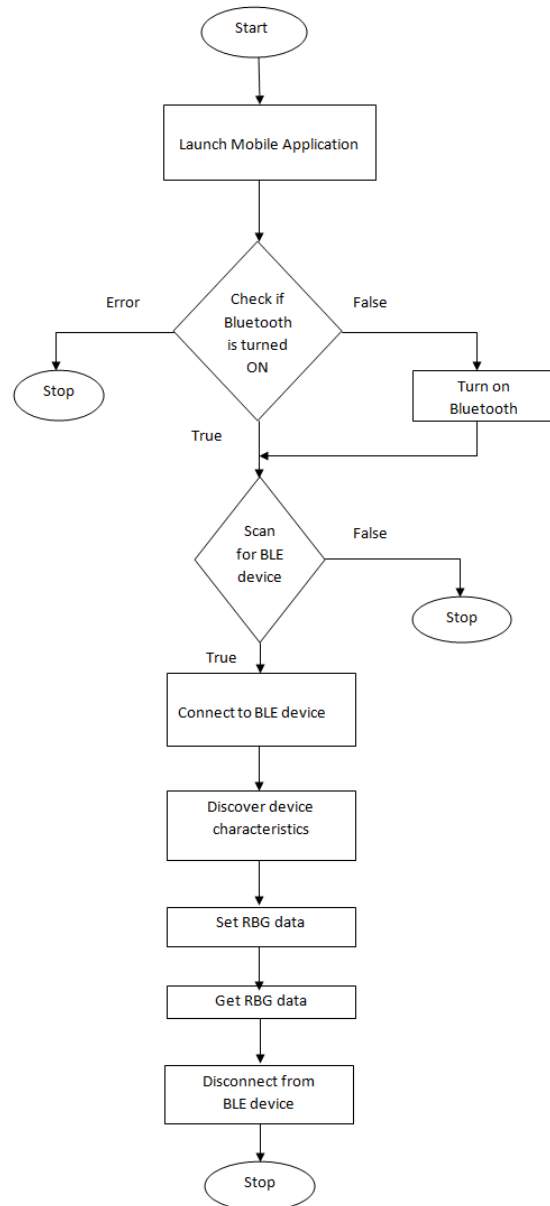


Figure. 4. Flowchart

IX. RESULTS

The user interface consists of required functionalities such as starting the Bluetooth service in the android smartphone, search for the available Bluetooth device such as Bluetooth low energy device and establishes connectivity from android smartphone. To execute the proposed solution for low energy smart lighting system using IoT and Bluetooth the user should have minimum configuration of desktop or laptop that support the software requirements. The device has to be equipped with Internet. Host system is used as laptop with Windows 10 professional, minimum 8 GB of RAM and 50 GB hard disk. Target system is used as Bluetooth Low Energy Toolkit CY8CKIT-042-BLE-A and BLE Pioneer Baseboard & Device CY8C424BLQI-BL-583 [13]. The Bluetooth Low Energy Pioneer Kit empowers clients to assess and create Bluetooth 4.2 agreeable arrangements utilizing the PSoC 4 BLE gadgets. The pack has been intended to take into account simple improvement with ease. The units outline and design takes into account clients to effectively create embed relations with arrangements. For smartphone minimum of Android version 5.0 is used to support the BLE device.

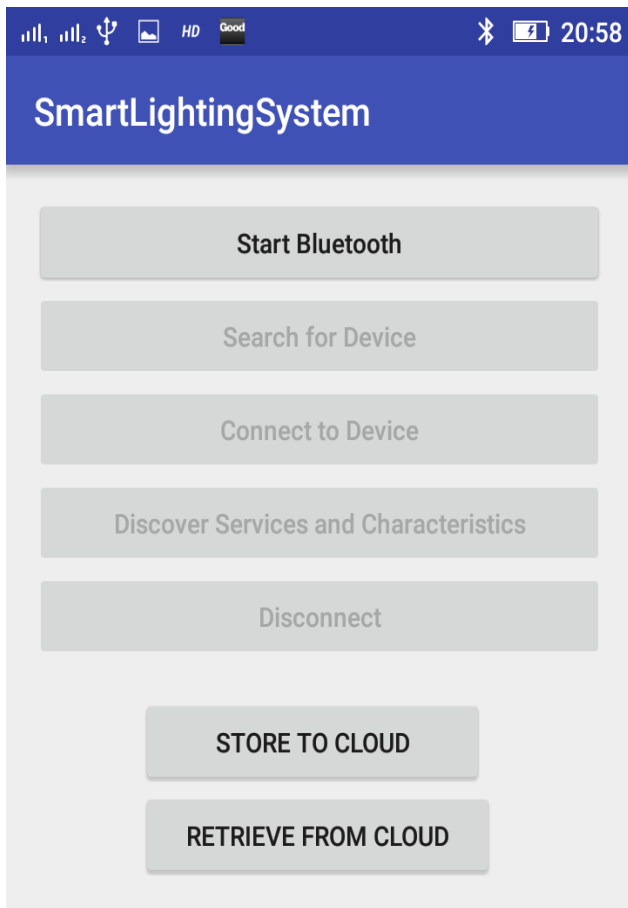


Figure. 5. Android Mobile Application

The smartphone is known as a clever smartphone since they are electronic gadgets that look like a wireless however are more similar to a versatile PC. The motivation behind smartphone was dependably to give a superior and simple life yet now it has likewise turned into a standard to quantify progressions in innovation. Right now over 76.6% of the smartphone models utilize Android as their working framework (OS), and expecting that Android will be in savvy watches, tablets and auto soon. The software requirement for the proposed system is the minimum requirements for the Low Energy Smart Lighting System using IoT and Bluetooth system. The front end is designed using java and Android Studio is used as Integrated Development Environment. The cloud space where the data gets stored and retrieved is docs.google.com Android Studio with version 2.3.2, PSoC Creator Release 4.0 and Google doc are used to build the application. Android Studio gives the speediest apparatuses to building applications on each sort of Android gadget. World-class code altering, troubleshooting, execution tooling, an adaptable form framework, and a moment fabricate/convey framework all enable you to concentrate on building exceptional and excellent portable applications. Parcel of designers needs to get related with Android application due to its unfathomable development in the IT area. Bluetooth innovation has been a standout amongst the most utilized advancements when an association must be set up with a remote gadget [5]. Generic Access Profile (GAP) is utilized to build up network between bluetooth based host and target gadgets. Covering the utilization model of the lower-level radio conventions to characterize parts, techniques, furthermore, modes that enable gadgets to communicate information, find gadgets, set up associations, oversee associations, and arrange security levels, GAP is, basically, the highest control layer of BLE [7]. Generic Attribute Profile

(GATT) characterizes how information can be trades for bluetooth based host and target gadgets [6]. GATT additionally gives the reference structures to all GATT-based profiles, which cover exact utilize cases and guarantee interoperability between gadgets from various sellers. All standard BLE profiles are in this way in light of GATT and must follow it to work effectively [7]. PSoC is an Integrated Design Environment (IDE) that empowers simultaneous equipment and firmware altering, gathering and investigating of PSoC frameworks. Applications are made to interface with fringe gadgets. Google docs are capable continuous joint effort and record composing instrument. Numerous clients can alter a report in the meantime, while seeing each different change promptly. Clients can deliver content reports, slide introductions, spreadsheets, drawings, and studies. The arrangements utilized are good with Microsoft Office and Open Office, so you can switch between these projects as required. All communications and documents are contained in Google's Internet servers (the cloud), and are open from inside a web program window.

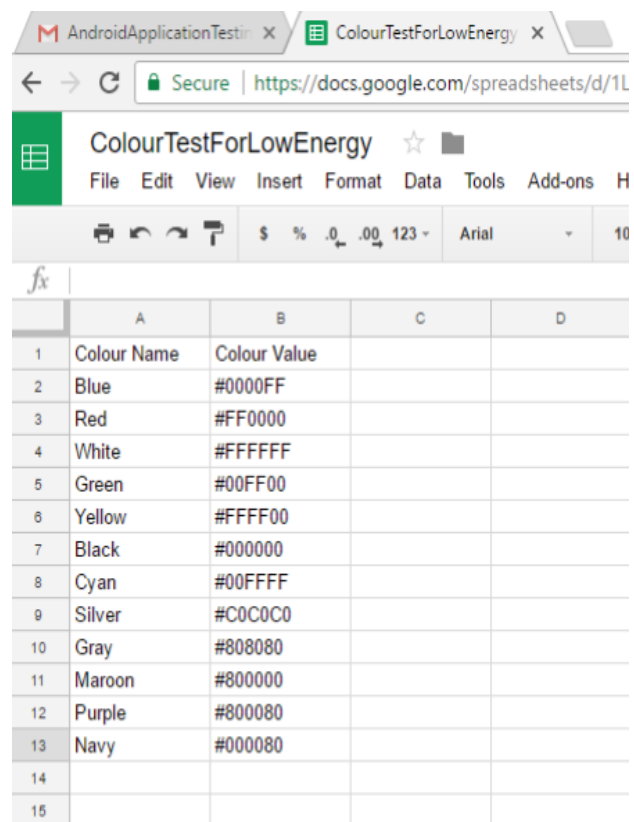


Figure. 6. Color configuration data stored in cloud

X. CONCLUSION

The end client gets the information from cloud and changes the coveted shade or color of LED utilizing low vitality based bluetooth. We finish up the key advantage of Bluetooth low vitality gadgets are interoperable and work at low vitality. Bluetooth Low Energy gives the chance to associate new sorts of gadgets that can be more quick witted and less expensive. Low Energy Bluetooth innovation can be extremely helpful in home systems since no link associations are required to speak with gadgets. Bluetooth 4.0 is the latest standard version and is also known as Bluetooth low energy. Bluetooth low energy device components are less expensive and multi vendor operability. It is apparent that an assortment of new application thoughts can be created by performing verification of idea and playback sessions on low vitality Bluetooth gadgets to clients.

XI. FUTURE WORK

The low vitality savvy lighting framework utilizing IoT and Bluetooth can be reached out to WiFi gadgets to cover huge scope of gadgets and iPhone. Utilizing android smartphone and bluetooth innovation client can get cautions, if any of the associated gadgets have finished the undertaking and can raise alerts, if there are security framework disappointments. Low Energy Bluetooth innovation might be utilized as a part of medicinal field to direct restorative tests for patients without links or wires associated with checking gadgets. Patient's information can be put away and recovered utilizing Cloud. In view of arrangement for therapeutic test, particular patient information can be set in checking gadget utilizing Cloud.

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