

Bluetooth Low Energy Based Smart Switch

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Abstract

This project presents the entire resolution for dominant and watching sensible switch by mistreatment Bluetooth Low Energy (BLE) as a Referent device, associated an application enforced on automation OS.BLE, additionally referred as blookh sensible, could be a low power overwhelming wireless technologies. This method is dole out by delivering necessary directions to peripherals with facilitate of automation applications and observant output by witnessing functioning of electrical appliances. Smart home has become more and more popular in recent years. It aims at serving to individuals manage the house appliances freely associate degreed build an autonomous setting in home or work space. This project introduces BLE supported net protocol to manage the good home units simply. Based on this approach, a design of a fan system with related software and hardware is implemented. People can use smart phones or tablets to control or monitor fan both locally and remotely. Low cost BLE module is used to build smart switch.

Keywords: *Bluetooth low energy (BLE), smart switch.*

INTRODUCTION

Overview

In the progressive era of 21st century, technology is an essential part of living. By using these technologies the Development and Design of a product is commanding and preferable. Using BLE mobile application manages the appliances through this system.[1]. BLE is associate in nursing approaching and rising technology used for already established. In spite of its installed base in smart energy, homeland building automation applications

Bluetooth Low Energy

("Bluetooth Smart") is referred as Bluetooth Low Energy wireless protocol which splits the sphere in various types of peripheral devices, such as sensors and speakers, and central devices, such as your smart phone or laptop. Peripherals could be able to connect single central device or "advertising packets." to broadcast information other device. When

connection is maintained, the central device had every service information which is offered by the peripheral. So, for our sensible Switch, a BLE peripheral with one service is formed. It has two characteristics: "Switch," is the read/write representative that is used to tip over the switch on/off by us, and next representative is called "State," that inform us the switch change status throughout. Fortunately each service and features have their personal Universally Unique Identifier (UUID) number, so that anyone can simply plug existing BLE services right into the code for our project.

Smart Switch

A smart switch is remotely worked with BLE wifi networking, so anyone can manage every device by the use of all kinds of mobile devices and also switch turn the appliance on and off. Switch must be knows their present status — in other words, whether the device is on or off and also sends notifications [1].

BLE vs. Other Wireless Solutions

In home automation it is compulsory to hold out associate analysis of wifi protocol which commonly deployed before introducing the answer. Whole network achievement on that the HEM resolution relies which is determined by the wireless protocol so, it is very important to select. Some facial appearance which is given below after selecting acceptable short-range wireless technology in home:

- **Cost of the radio technology:** Radio Technology is also uses very low cost such as other small low-cost devices, to material billing; and sometimes it is also share the same computing engine (micro-controller) when needed.
- **Power consumption:** To influence supply of services some battery or quite power energy is also needed. Ease-of-use:
It should be simple with network and net services which are associated.
- **Security:** The wireless technology sufficiently supported cryptography should be sufficiently supported at end-to-end position. (At the every stage security is compulsory as between sensors and net services).
- **Obtainable ecosystem:** the chance to attach to sensible phones, tablets, PCs, home gateways, etc., is important; this demand additionally drives volumes and has a vital impact on the value (a model is Bluetooth Classic, wherever the big volumes of phones and phone accessories have lowered the costs).
- **Range:** it has good capability to cover the range or to extend the coverage (repeaters, routers, etc.) without adding any external system when needed [7].

Objectives

The main objective of this project is to control the fan with the android application. We can automatically on and off the device with the help of the app. with the Bluetooth low energy module it can cover a distance of up to 100m. The

version of Bluetooth low energy module is 4.1. The second objective of the project is to control the fan based on the temperature. It is carried out using the thermocouple which is used as a temperature sensor. During the programming the temperature is set and once the thermocouple reaches that temperature the fan will automatically switch on without even with the help of android application.

LITERATURE SURVEY

Yan Wenbo, Wang Quanyu explained the importance of smart home system by stating as Smart home has become more and more popular in recent years. The main aim is to help the individuals to control the home machine easily and construct a self-directed atmosphere in household. Hence in their paper Smart Home Implementation Established on Internet introduces a wireless solution based on Internet procedure to accomplish the smart home-grown components effortlessly.

Aayushi Kothari, Anar Pandyam introduced a wise system victimization Bluetooth low energy, put in reception to regulate electrical appliances within the paper sensible Home victimization Bluetooth Low Energy. This method is allotted by delivering necessary directions to peripherals with the assistance of mechanical man application and observant output by witnessing functioning of electrical appliances.

Mats Anderson delineate Bluetooth low energy technology operating and the way it is accustomed connect devices to Internet-based services and applications is a major feature in Bluetooth low energy compared to alternative IoT wireless technologies is that the support for sensible phones and tablets is clearly seen in his work case potentialities with Bluetooth low energy in IoT.

Bluetooth development portal, in “Bluetooth interest group”, describes the applications with Bluetooth. The portal contains data relating to Bluetooth specifications, report coaching videos and links to development resources.

One of the papers supported Home Automation describes the system as a system design designed and enforced at residing place wherever the aim is to convert place from boring, non-interactive to intelligent and economical energy saving place. This one is delineate by SS Ranjit, M.A Othman et.al in their work Home Automation System victimization mechanical man. In an effort to understand the use of sensors in the Home Automation, Silvin Folea, Damela Bordencea, Cariana Hatea has explored the specializations of sensors in measuring temperature, humidity, pressure, light etc... The explanation to transmute common community to smart home is proposed in Smart Home Automation using Wi-Fi low Power Devices with the help of wireless sensor networks.

Maria Collata and Giovanni pau accomplished a fuzzy based mostly answer to tackle energy management issue in home automation wireless network within the paper. An answer supported BLE for sensible Home Energy Management by. Power load of standby applications and their masses at totally different hours of the day square measure addressed. In “www.bluetooth.com“, information is about the Bluetooth permits numerous traditions to attach later first representing power of modest point to point connections.

Mauri Juhana Honkanen, explains in “Facilitating positioning through Bluetooth Low Energy wireless messaging” published on Feb 24, 2015 that Google patents describes the system for providing

positioning connected data inside wireless communication signals. Message could more compress data indicating handiness of positioning connected data from target equipment. The device could verify, based mostly received data. If determined to be obtainable, Device and target could move with one another. Bluetooth Low Energy constructed mostly wireless sensors defines however wireless sensors network (WSNS) have fascinated a lot of attention in recent years. Potential applications of wsns are vast. They used for grouping, storing and sharing detected Hassaf, Ronald Moto, Sunil R Das ,Emil M Petric in their paper “Sensor Based Home Automation and Security System.” convey the conventional design of home safety which stereotypically displays basically assets and deficiencies fleshly governor characteristics of home-produced itself. Vishwajeet Hari Bhide, Dr, Sanjeev Wagh in their work “i-Learning IoT: An Intelligent Self Learning System for Home Automation Using IoT” describes about the extension of current internet to provide communication Connection and inter-networking between various devices or physical objects.

METHODOLOGY

The functioning of the total system starts with Associate in Nursing mechanical man application. The command is shipped from Associate in Nursing application by enabling Bluetooth feature in mobile.

BLE module connected to appliances like tube light-weight, bulb, fan, etc. that receives command from various mechanical man application. During this project a devotee is employed because the electrical appliance. The command from which is received reassigned to organizer unit of BLE segment. The module then processes the command and also the final

output is sent through output device. Bluetooth Low Energy works as Central. The main aim is to connect mobile android application as an important unit and Peripherals are electrical appliances [5]. After establishing the connection peripheral and central can share the data to one and another. At all break, Peripheral promotes packets to discover the device. At the same time, scanning process is commenced in central device which sends a request to peripheral and in response, device is discovered. After finding device, connection is established by a request from central and a response from Peripheral. Connection, combining and affection of expedient are definite subsequently an interchange of protected opener, which Promote exchange of data. For functioning of peripherals, a module of BLE is interrelated through utilizations in two

altered methods. It is either mounted on hardware, replacing and modifying the conventional infrared framework, or connected with the switch board through controller, for proper transmission and reception of instructions. This process completes the cycle of operation [6].

The hardware components used in the project are explained in the next sections

- A BLE module of part no KT 1010
- A Relay to interface the output from module
- One of the temperature sensors, thermocouple
- A fan to show the features

Fan is used as a smart home unit, and many features can be added for the implementation of smart home.

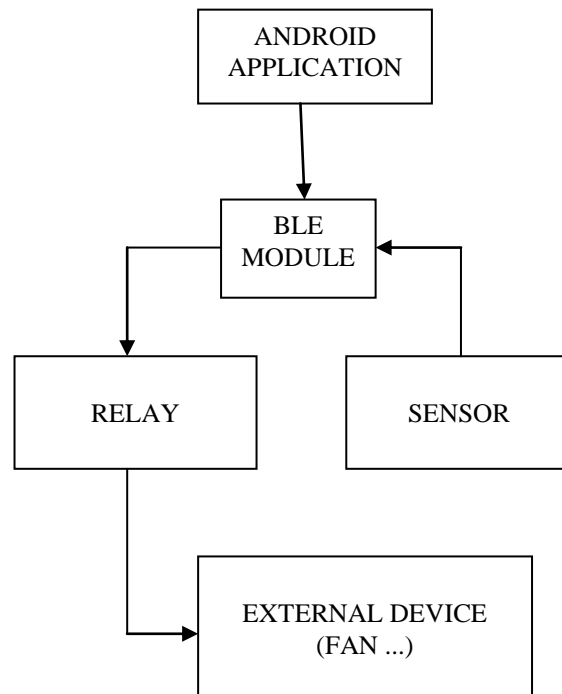


Fig 1. Block Diagram of BLE switch

BLE Module

Bluetooth module permits the transfer of easy information between compact devices gap up a totally new category of Bluetooth applications like watches, TV remote controls, medical sensors and

fitness trainers, building a scheme exploitation Bluetooth low energy (BLE). BLE establish a connection very shortly than conventional Bluetooth wifi technology. BLE absorb less power approx. 20% than Bluetooth

Basic Rate [8]. Kaynes Technology is specially Asian Nation Corporation in the direction of preliminary Bluetooth sections on CSR primarily based chipset in India. Mass-produced to grip an expansive show a discrepancy of machineries, fashionable Technology's BLE modules may be designed into numerous styles of electronic devices.

Relay

A relay is Acquaintance in nursing electrically activated the switch. Quite a lot of relays usage Associate in nursing lodestone to habitually function a switch, though altered operational principles are recycled, similar solid-state relays. Relays are used wherever it's must to manage a circuit by a single low-power signal, or where on earth countless circuits have a duty to be separately managed. Relays are used where it is very important to manage the high power or high voltage circuit with a low power circuit, especially when galvanic isolation is needed. The first application of relays was in lengthy telegraph lines, where the pathetic signal received at a medium station could manage a contact and regenerated the signal for additionally transmission. High-voltage or high-current devices may be controlled with little, low voltage wiring and pilots switches. Operators may possibly be sequestered from the extraordinary electrical energy circuit. Power devices Near to the ground for example central processing unit can effort relays to resistor electrical heaps further than their unswerving effort capability [12]. The relay in this project facilitates the output accurately without any breakdown of any parts of the system.

Thermocouple

Temperature sensor is a device, characteristically, a thermocouple which quantifying hotness by way of an electrical signal. A thermocouple (T/C) is ready from two contradictory metals that

produce electrical energy in uninterrupted fraction to fluctuations in temperature [2]. A thermometer could be a device created by 2 completely altered wires united at one appearance, discussed to as interchange appearance or measurement texture. The 2 wires square measure referred to as thermo components or legs of the thermocouple: the 2 thermo components square measure distinguished as positive and negative ones.

Software

CSR Microenergy SDK a pair of.4.5.13 is that the package tool used for the implementation of the planned system. CSR package is Associate in nursing integrated web-based resolution that monitors and tracks CSR metrics with knowledge assortment, consolidation, reporting, and management capabilities for long company CSR property and CSR performance. Bluetooth low energy technology permits property and knowledge transfer to leading Smartphone, pill and private computing devices as well as IOS, Android, Windows Phone eight and Blackberry OS10 devices. CSR places the sensible phone at the center of the web of Things sanctioning Associate in nursing nearly unlimited range of Bluetooth low energy technology enabled devices to be merely networked along and controlled directly from one smartphone, pill or laptop. CSR supports profiles for health and fitness sensors, watches, keyboards, mice and advanced remote controls

IMPLEMENTATION

Android 4.3 (API level 18) introduces inbuilt platform support for Bluetooth Low Energy (BLE) within the central role and provides genus Apis that apps will use to get devices, question for services, and transmit info. Common use cases embrace transferring tiny amounts of information between near devices and additionally interacting with proximity sensors like Google Beacons to offer users a custom-

built expertise supported their current location. In distinction to Classic Bluetooth, Bluetooth Low Energy (BLE) is intended to produce considerably lower power consumption. This gives the necessary time for Android apps to transmit with the BLE devices that meet stricter power requirements, like proximity sensors, heart rate monitors, and fitness devices. Generic Attribute Profile (GATT) profile is a general specification for sending and receiving short pieces of data known as "attributes" over a BLE link. All current Low Energy application profiles are based on GATT. When an Android device communicates with a BLE device is Central vs. peripheral the roles and responsibilities are apply on them. This applies to the BLE connection itself. The device in the central role scans, looking for advertisement, and the device in the peripheral role makes the advertisement and also GATT server vs. GATT client. This is measure that how two devices are communicated with the each other after established the connection between. To understand the excellence, imagine that you simply have associate degree mechanical man phone associate degree an activity hunter that's a BLE device. The phone supports the central role; the activity hunter supports the peripheral role (to establish a BLE affiliation you would like one in all each—two things that solely support peripheral could not talk over with one another, nor might 2 things that solely support central). Once the phone and therefore the activity hunter have

established an affiliation, they begin transferring General Agreement on Tariffs and Trade data to 1 another. Reckoning on the sort of information they transfer, one or the opposite would possibly act because the server. For instance, if the activity hunter needs to report device knowledge to the phone, it'd add up for the activity hunter to act because the server. If the activity hunter needs to receive updates from the phone, then it'd add up for the phone to act because the server. In the example used in this document, the Android app (running on an Android device) is the GATT client. The app gets data from the GATT server, which is a BLE heart rate monitor that supports the Heart Rate Profile. But you could alternatively design your Android app to play the GATT server role [12]. There are few key points in BLE implementation. BLE peripheral cannot connect more than one central device at a time. When a Client requested for sending the data then the Server send the data it cannot send data by itself. Whenever any value in the database varriates the alerts and demonstrations are actions applied by the Server. The CSR (Cambridge Silicon Radio) software is used to design the application Bike Security based on GATT server. In order to use Bluetooth options in your application, you want to declare the Bluetooth permission. You would like this permission to perform any Bluetooth communication, like requesting an affiliation, acceptive an affiliation, and transferring knowledge.

Flowchart

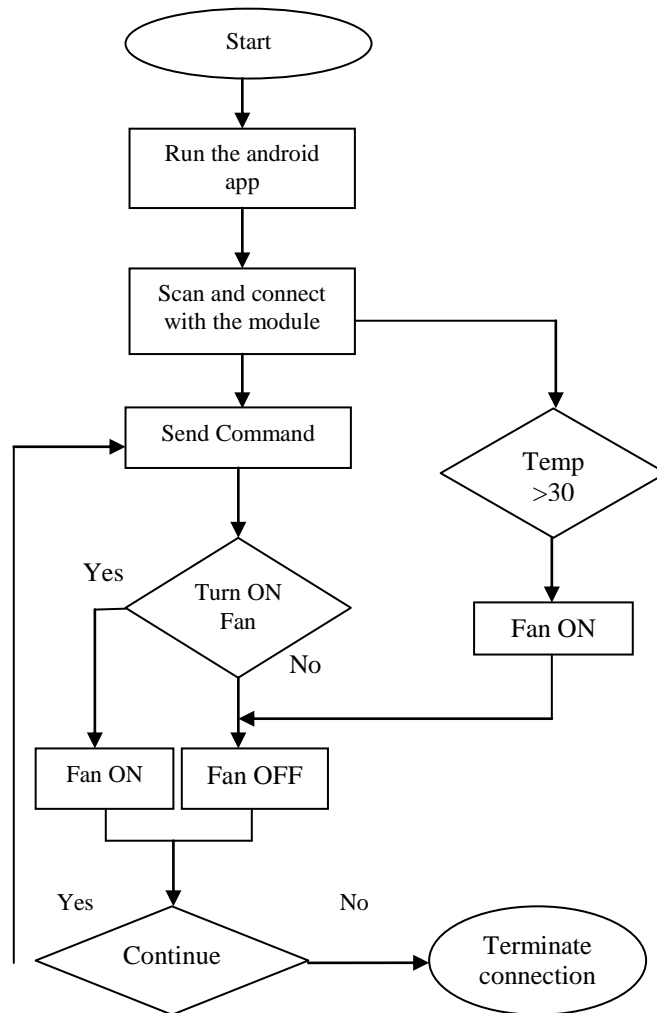


Fig 2. Flowchart of the process

RESULT

Switch ON/OFF of a Fan

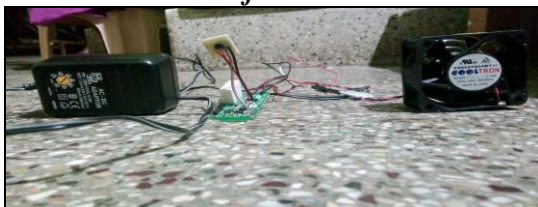


Fig 3. Fan switched on

Control of Fan using Thermocouple

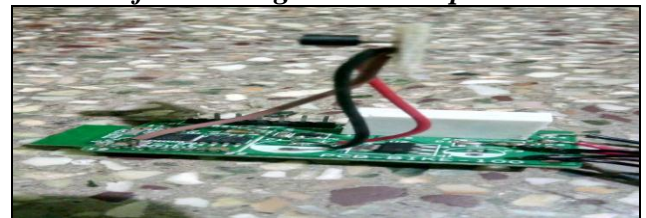


Fig 5. Thermocouple



Fig 4. Fan switched off



Fig 6. Fan ON from sensor

Advantages

- Security.
- The loss of power can be reduced and manpower required for home automation is very less compared to conventional methods.
- By using a home automation system, we can save a lot of time to operate home appliances from anywhere.
- Low power.
- Mobile app connectivity.
- Power consumption is also very less when compared to other microcontrollers. When we see in the programmer point of view interfacing is very easy, also we can connect analog devices directly without any extra circuitry and use them. Programming is also very easy when compared to other microcontroller.
- Pic controllers are reliable and manufacturing of pic percentage is very less

Disadvantages

- Accessible to limited distance.
- No direct voice command to the BLE.

Applications

- In Home Automation systems, to control house hold appliances.
- In Industries, to control machines in a simpler way.

CONCLUSION

In this project, a flexible, low cost smart home system based on BLE is proposed. Low cost BLE module is used to make smart units. Comparative apps centered on altered display place can be technologically advanced and android app is recycled to make evident an organization.

Future Work

In future this framework will be expanded by dominant numerous appliances and

machine victimization Bluetooth Low Energy the thought of observation Appliances like TV, Music players, icebox etc will be procured victimization an equivalent technology. Moreover, this approach isn't solely restricted to good home however even be acquire in various field by implementing at offices, Restaurants, gymnasium canthers etc.

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