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# Survey on Controlling IR Legacy Devices

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**Abstract -** *In this paper, we have introduce a low-cost setup to convert an infrared (IR) controllable device to a smart IoT device. Legacy infrared (IR) devices are pervasively used. They are often controlled by IR remotes and cannot be controlled over the Internet. A trustworthy and cost-effective smart IR system that is able to change an IR controllable device into a smart IoT device and interconnect them for smart city/home applications is offered in this paper .Today, Infrared remote control technology has been applied to various aspects of our life and production. It is used not only in the high-end technology, such as aerospace, but also in all kinds of remote controls in our daily life. We use Legacy IR devices in our day to day life for that we are still using remote controls. Hence for that there are various ways we can connect IR devices. Also we have described a webized augmented reality mashup for legacy things that connects existing web services with things without the additional cost of replacing existing devices. Also describes a way that legacy Device Bridge performs protocol conversion to enable a network- work-attached entity. As well device for providing a service record for an application (e.g., a legacy application) running on a virtual serial port of a wireless transceiver device, such as a Bluetooth-enabled device is mentioned. The methods which are described in this paper uses Bluetooth, cloud server which uses MQTT protocol, ZigBee protocol, Webized augmented reality mashup, Fog/edge computing. As well as security concerns regarding the method which will help to control IR legacy devices is discussed in this paper. Technologies which are used for controlling IR devices are discussed*

***Key Words*: IR legacy devices, ZigBee protocol, Fog/edge computing, Webized augmented reality mashup, Bluetooth.**

## 1. INTRODUCTION

Home automation market is very auspicious sector which is developing rapidly. It requires extensive range of developments that can be made in the idea of smart homes. IoT has broad applications including smart home, smart city, smart grid and smart transportation. However, there still exist a large number of legacy devices such as infrared (IR) controllable devices, which cannot be controlled over the Internet[7]. Home automation is also known as domotics. This involves the control and automation of lighting, heating, ventilation, air conditioning, security. It also includes control and automation of home appliances such as washers/dryers, ovens or refrigerators/ freezers. Home automation is a modern technology that transforms your home to an extent that it can perform different sets of task automatically. This technology is constantly upgrading its versatility by integrating modernized features to fulfill the increasing demands of people .Main purpose of home automation system is to save electricity. Smart home automation is beneficial for us as it added more comfort. [10].The infrared technology is used in many different fields including scientific research, business, and military. The infrared spectrum can be divided into five categories: near infrared, short wavelength infrared, mid wavelength infrared, long wavelength infrared, and far infrared [11] This paper contains various methods to connect IR legacy devices to our phones which will make our work to control IR devices easy. This paper demonstrate various ways to control IR legacy devices like TV, AC

## 2. LITERATURE SURVEY

In 2004 David Kammer [1] patent a method and device for providing a Service record for an application(e.g., a legacy application) running on a virtual Serial port of a wire-less transceiver device, such as Bluetooth enabled devices. It can lose connection in certain conditions. It has low bandwidth as compared to Wi-Fi. It allows only short range communication between devices.

In 2011 Paul Krzyzanowski, et al [3], carried out study of the legacy device bridge which translates between packet-based communication protocols, such as TCP/IP, and communication protocols used by legacy electronic consumer IR devices, such as IR and serial protocols, in order to perform this function. It is slower compare to repeaters because of filtering. It does not filter broadcasts. It is more ex-pensive compare to repeaters.

We can configure controllable CE de-vices based on user's mobility and minimize power consumption based on ZigBee ON/OFF control technique using multiple level timers. The zigbee has flexible network structure. It is low power consumption. For official private information it is highly risky. The zigbee has low transmission rate .It is not secure like wifi based secured system. A dynamic control scheme for multiple legacy IR controllable digital CE devices based on ZigBee protocol was proposed in 2007 by Wan-Ki Park, et al [2].

In 20017 Daeil Seo, et al [4], have published their paper in which they described webized augmented reality mashup for legacy things that connects existing web services with things

without the additional costs of replacing existing equipment. Inconvenient Gear. Lack of industry standards.

G. Xu, et al [5], has listed the smart grid, as one of typical applications supported by Internet of Things. The main advantage is that it provide reliable, secure, and efficient energy transmission and distribution to consumers. Proposed model is directly applied tolarge scale power grid, it is difficult to obtain the optimal strategy for minimizing power cumulative cost.

A home automation system that uses IR remote, Bluetooth and GSM to control AC appliances using android app is introduced that is easy to use over the traditional method of the switch was discovered by Anuja Shinde , et al to provide a way to access home automations system in easy way. Some systems which are currently available provide a view of the house from a web application; but this can cause trouble to the user. Because user have to access the web each time he/she wishes to view the status of the home appliances. Hence, the reason behind the development of this system is to let people know about these technologies, and make the system as simple as possible for an ordinary person to understand. The result of this research is the implementation of home automation system which involves control and automation of home appliances through mobile application from remote locations[10].

J. Lin, et al [6] studied the "A survey on internet of things: Architecture, enabling technologies, security and privacy, and applications" said fog/edge computing can provide faster response and greater quality of service for IoT applications. Each fog/edge service node have limited computing and storage capability. Trust and authentication are major concerns.

A trustworthy and cost-effective smart IR system that is able to change an IR controllable device into a smart IoT device and interconnect them for smart city/home applications is offered in 2019 by Zhen Ling , et al in "STIR: A Smart and Trustworthy IoT System Interconnecting Legacy IR Devices" research paper [7].

## 3. LIVE SURVEY

In early 2019 by combining a novel hardware-accelerated serial interface and a conventional Internet of things (IoT) gateway we had implemented a machine-type communications. All home appliances with an infrared (IR) remote controller can be accessed through the Internet. Right now we use, application paradigms human-type communications but in near future will transfer to machine-type communications to provide services such as health care and smart-home control systems. That's why , commercial IoT gateways are required for intranet-Internet bridging of various wireless access services. We built a smart-home control system, which enables an IR signal to be remotely controlled to emit through the Internet which will anchorage IR control capabilities. The implemented system produces a hardware-accelerated serial interface to sample IR signals—including extremely high-frequency signals—and includes a hardware-based data compression mechanism able to reduce the size of oversampled data and save flash memory space. A more intelligent control style can thus be realized by leveraging existing home appliances for the smart-homes of the future [9].

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In early 2019, Zhen Ling , et al [7] discussed concerns regarding methods of controlling IR legacy devices .Since consumer IR devices are lack of regular encryption of their IR codes, security concerns can arise. For instance, TVBGone can turn on/off TVs by replaying known codes. It takes about two minutes for TVBGone to replay all the codes, and this is definitely a congruent time frame for the attacks of any TV . As for our IR transceiver, it is able to keep account of any IR codes from IR controllable devices and run these codes accordingly. Under the control of a Raspberry Pi, this IR transceiver is prone to being customized to attack any device that is controlled by IR.

## 4. TECNOLOGICAL SURVEY

### 1. Bluetooth:

Bluetooth is the code for a technology specification for short-range radio links that will allow the many proprietary cables that connect devices to one another to be replaced with Short-range radio links. The Bluetooth technology is based on a high performance, yet low-cost, integrated radio transceiver[1].

### 2. Legacy Devices Bridge:

The legacy device bridge performs a task of converting a protocol to enable a network-attached entity that uses a packet based communication protocol to communicate with and control legacy devices, such as consumer electronics, that rely exclusively on infrared (IR) or serial communication protocols[3].

### 3. ZigBee:

The IEEE 802.15.4 standard was based on Motorola's mid2001 proposal and was ratified in May 2003.As designed and without special equipment it is clear that ZigBee has the potential to operate over a greater range especially in 'low clutter'-radio environments[12].

### 4. Augmented Reality:

Augmented reality (AR) technology add virtual objects or related information to physical target objects on the screen through camera streaming. In existing works, AR provides an interface for user interaction with IoT devices on the screen[4].

### 5. Raspberry Pi:

Raspberry Pi is a lightweight computer that runs on an ARM CPU. A Pi may run various operating systems. In this paper, all Raspberry Pis use Raspbian, a Debian-based Linux OS system [7].

### 6. MQTT:

Message Queue Telemetry Transport (MQTT) is a popular lightweight protocol to implement IoT communications. MQTT is a topic-based, publisher and subscriber messaging system. A message contains a message topic and message payload. The topic is a unique string that serves as the identifier for a type of message. A publisher is any client that sends messages. A subscriber is any client that listens for incoming messages of a particular topic[7].

### 7. Arduino UNO:

The Arduino Uno is an Atmega328 based microcontroller board. This microcontroller board has 14 digital I/O pins out of which 8 pins we have used for interfacing home appliances. It also has a USB connection, power jack and a reset button. It is used to decode the signals sent by IR remote, Bluetooth and GSM and accordingly send the control signal to relay module. Bluetooth module HC-05 and GSM module SIM800 are serially interfaced with Arduino. IR receiver TSOP 1738 is interfaced to digital input pin of Arduino Uno[10].

### 8. MIT APP INVENTOR

We have used MIT App inventor to develop android application for Bluetooth and GSM features. It is initially provided by Google. Now it is maintained by Massachusetts Institute of Technology (MIT). It is an open source web application for android. Apps created in app inventor (.apk files) can be ported to any android smart phone[10].

### 9. GSM Module

SIM 800c is a GSM/ GPRS module. It is designed for global market. When a specific button is pressed on GSM home automation screen of application, SMS from Smartphone is sent to the GSM module SIM800c interfaced with Arduino. Based on SMS sent appliances are switched ON/OFF. At the same time Arduino sends current status of the devices by SMS via GSM module to Smartphone[10].

### 10. TSOP 1738:

The TSOP 1738 is an IR receiver. TSOP 17xx has active low output. Output signal which is demodulated by TSOP can directly be decoded by a microcontroller. It consumes low power and has high immunity against ambient light . When a button is pressed on IR remote it transmits infrared signals. These signals are demodulated by TSOP and then decoded by Arduino. After that Arduino sends control signals to relay module according to that devices switch ON/OFF as per the button pressed[10].

## 5. CONCLUSIONS

A dynamic control scheme is proposed for multiple legacy controllable CE devices based on IEEE802.15.4, especially ZigBee protocol. The key advantage of GSM system is if control circuit fails then manual switching option of traditional method is available. A powerful technology often has two sides. We also discussed potential security threats arising from our IR transceiver. This shows over the years we have discovered various methods to control IR legacy devices. Each method has it's own advantage as well as disadvantage. Each new method has overcome the disadvantage of previous one. We expect our proposed method to help people use legacy devices with AR technology and fill the technical gap until IoT devices are widely available.

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