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Hybrid Smart Home using traditional & IOT Controls

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Abstract: ***Now-a-days, IOT implementation has been a trend-worldwide. The ease of operation, power savings, and the analytical data that we gather from those devices has been a big boon for the industry. However, hassle-free adoption of newer systems, has always been an issue in terms of monetary costs as well as in regards to the familiarity with the original design. While there have been many studies which have focused on the aspects of costs, seldom they are with the objective of facilitating ease of transition from one familiar class of generation of products to the next. Our prototype product taps into this very aspect of familiarity. It is based on a microcontroller-based relay system, comprising of Node MCU - ESP-8266 microcontroller, relay module and house-hold piano buttons. It facilitates ease of operation, while maintaining backwards compatibility. Our prototype is a blend of two systems, with traditional system working in conjunction with the new IOT based systems, making a hassle-free user experience, while at the same time increasing the safety and durability of the switches.***
Keywords: Node MCU, ESP8266, Piano Switches, Traditional Buttons, IOT, Relay module, Blynk.io, Wi-Fi, Android app

I. INTRODUCTION

Now-a-days, IOT implementation has been a trend-worldwide. The ease of operation, power savings, and the analytical data that we gather from those devices has been a big boon for the industry. Node MCU – ESP8266 has been an inexpensive yet powerful microcontroller with Wi-Fi and Internet capabilities making it perfect for the project. Several different platforms have emerged for IOT based applications, from Amazon AWS, Samsung Smart things to Blynk, each serving variety of operations. It has been observed that using already existing platforms to suit and tailor your needs has been more economical from both time and cost perspectives than setting up a server. The future of IOT will include a lot of other aspects ranging from our own household appliance suggesting a pattern of lighting, audio based on users' previous patterns as well as based on what kinds of patterns would look best to the given set of conditions using AI, Image analysis, etc. Cupboards equipped with IOT devices that would suggest required grocery items, their consumption, their analysis in regards to health, comparisons with people in similar region to Wardrobes analysing clothes, their types, storage conditions, their need for wash and iron cycles, etc. can all be seen in the coming future of IOT. While at the same time, the opportunities for IOT in the agriculture sector are still evolving ranging from AI & ML to analyse the lands, crop patterns, and more. There are various ways of communications between these devices, Zigbee being one of the preferred protocols for power saving and nearby communication, to standard Wi-Fi for making it most compatible with most of the existing systems as well as for communicating in larger areas. While IOT is being implemented, there lies a huge challenge for making users adopt it hassle freely. The costs of implementations of such systems have been 10 to 20 times the standard systems. Further in projects where home automation along with touch-based switches have been used, they have presented challenges to operation during power cuts. Their durability has also been observed to be less than the traditional piano switches we use. Adding Further costs in implementation. While it has been also seen that implementing IOT is cumbersome certainly to senior citizens, hence in such scenarios, a blend of such systems will provide a hassle-free experience to variety of users.

II. OBJECTIVES

Making IOT widely available.
Making IOT easy to adopt
Increasing safety in system operations
Provide better aesthetics where traditional systems provide better aesthetic suitability
Allow Senior citizens to continue using their systems, in more or less similar fashion.

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III.HARDWARE COMPONENTS

Node-MCU ESP 8266 microcontroller cum Wi-Fi Module
Relay Module
Traditional Buttons a.k.a. Piano Switches
Smart phone / Laptop
Wi-Fi Router

Fig. 1 Node MCU -ESP 8266

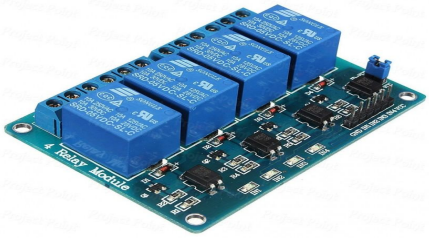

Fig. 2 Relay Module

Fig. 3 Piano Switches

IV.SOFTWARE COMPONENTS

Arduino IDE
Blynk.io mobile and web software(s)

V. IOT ARCHITECTURE

The IOT architecture consists of software layer as well as hardware level. The hardware level consists of Piano Switches, Node MCU, Wi-Fi Router which communicate via various protocols. The physical Switches act as sensing mechanisms to give feedback and state of them to the microcontroller. The microcontroller communicates to the Blynk Server, with the Wi-Fi Router being one of the hops, The Blynk server receives input from the user via Android or iOS app, web browser as well as the module itself. This data is synced with the server, with priority given to the most recent change in state to be synchronized to the server and consequently to the Node MCU module. The Node MCU module also hosts its own web page for the purpose of controlling it offline from devices on the local network. In all, there are 5 different ways to operate the module.

VI.THE USER INTERFACE

The User interface consists of 3 different types of UI's ranging from 2 similar UIs provided for the Blynk app for iOS and Android, the 3rd one being the web-based portal and the 4th one being the offline website. Buttons are used in the UI to operate as well as show the state of the relay modules. The user can Login into any of the apps or web-based portals, or access the device from any device on local network using its local IP.
For the purpose of connecting the device first time, the Node-MCU module itself acts as an access point, to which users connect to and access the Wi-Fi Configuration page using the mDNS based service, by typing in "ezswitching.local" and choosing their Wi-Fi Network, and typing its password.

Fig. 4 WiFi Settings

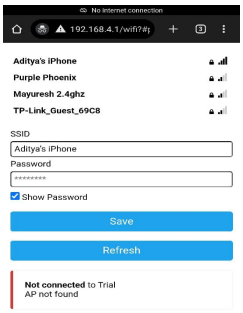

Fig. 5 Available APs

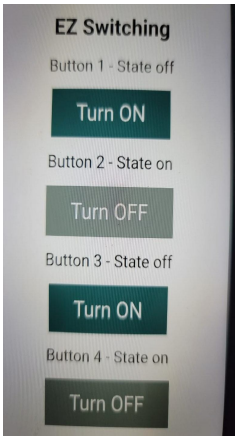

Fig. 6 Offline

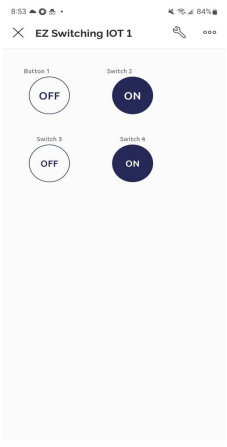

Fig. 7 App Interface

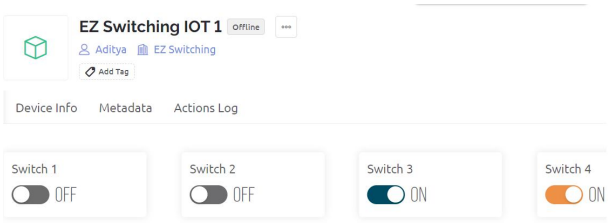

FIG. 8 BLYNK.IO WEB INTERFACE

VII. WORKING OF THE SYSTEM

The system uses Blynk libraries for ESP8266-NodeMCU, it first pings a known server to check internet connectivity, while the Wi-Fi is connected, and goes in to a fallback state where it can be controlled using the traditional piano switches as well as the local ip of the module. When successful internet connection is established, it tries to connect with the Blynk Server and proceeds to synchronise the data. Data from server is continuously retrieved to offer best latency to the end user, while it is communicated back as soon as there is a change from the piano buttons / the local web page.

VIII. APPLICATIONS & FUTURE SCOPE

This kind of system can be implemented at all kinds of places, thus adding a degree of safety as well as convenience.
By adding further general components like light sensors, motion sensors in conjunction with this, the convenience factor of users will increase.

IX. SCHEMATIC DIAGRAM

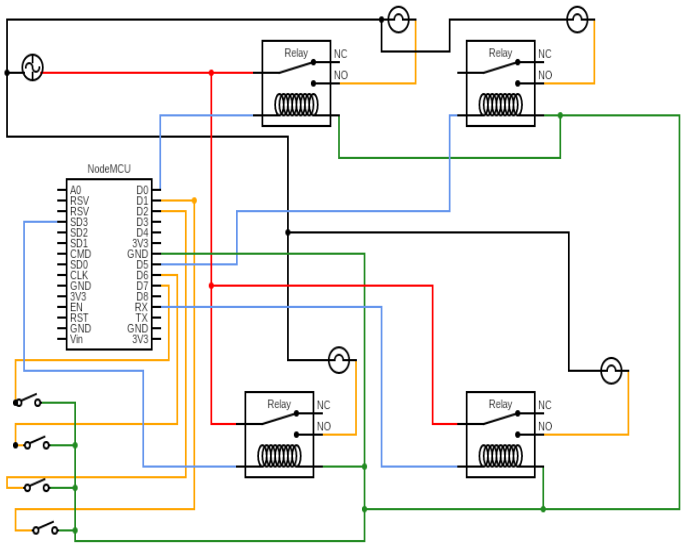

Fig. 9 Schematic Diagram

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X. REFERENCE REVIEW

IOT has been there for a long time, the comparison of various such platforms, their study from an end user point of view is done in [5], The information about Blynk platform is described in [2], its implementation in various home automation systems, and its wide scope has been referred in [4]. Details about the microcontroller NodeMCU ESP 8266 are given in [3] and [4].

In the Research Paper titled "Smart home Using Android Smart phone, Arduino Uno Microcontroller and Relay Module" [2] A basic smart home system is demonstrated using Blynk Server platform. Information regarding what various IOT layers from sensing and network layer to service and interface layer work comprise of have been referenced in [2].

XI. CONCLUSIONS

The IOT domain has a lot of scope to grow, as well as make users adopt to technology than force technology that IOT will be adoptable at the least possible economical costs, and changes in wiring to the end user.

Our Implementation provides a hassle-free all-in-one system assisting the elderly, while still being able to control the system remotely.

The traditional Piano buttons no longer use AC 110 / 220V power supply (depending upon the region), but work at 3.3 V DC of microcontroller and at currents rated in few milli amperes, thus adding an additional degree of protection to the end user as well as increasing the life of buttons.

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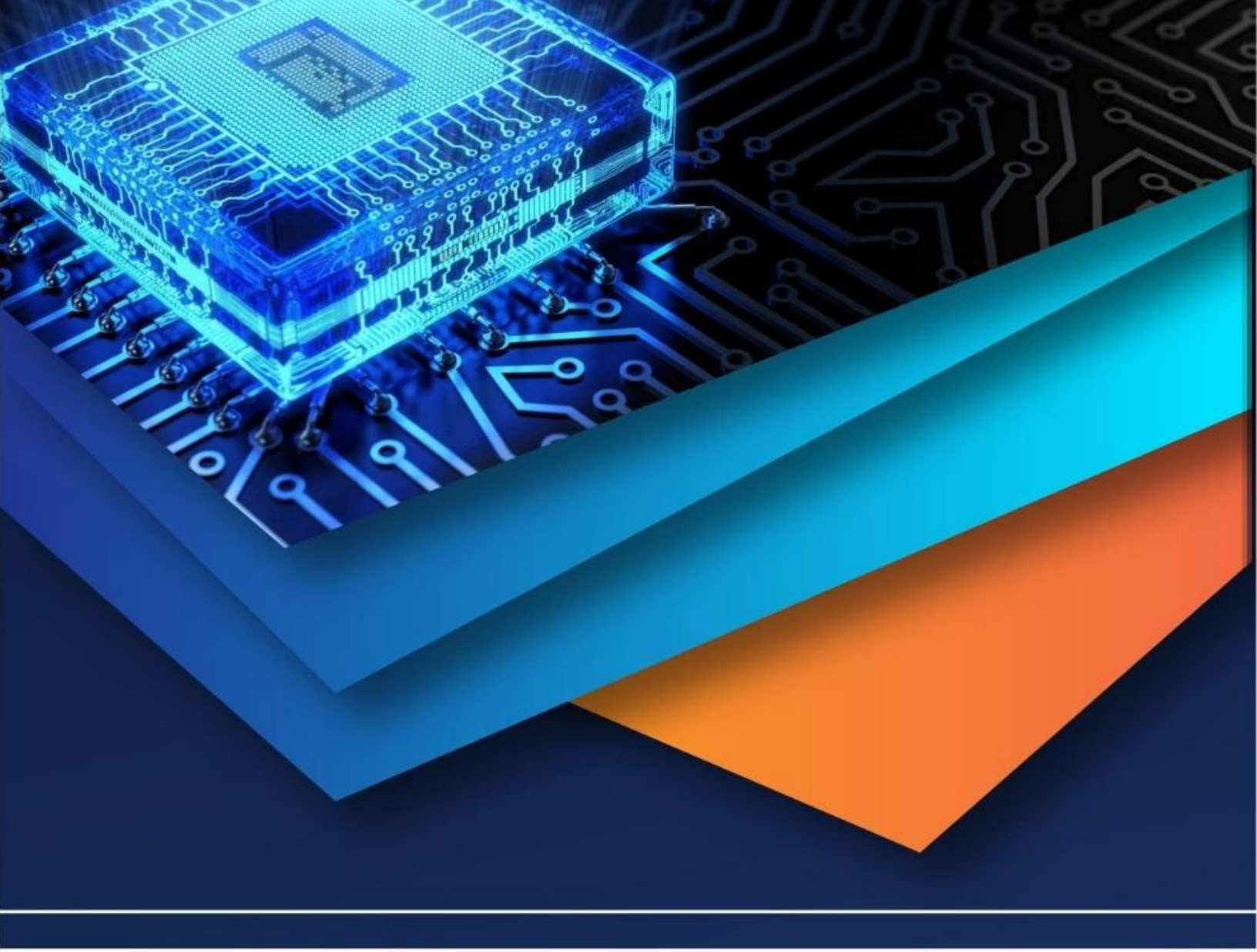

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