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Implementation of Smart Classroom Using AI and IOT

Prof. Dipali Dube, Abhay Nighot, Siddhesh Kharge, Prasad Naykodi, Omkar Fulsundar

Department of Computer Engineering, Vidya Niketan College of Engineering, Sangamner, Bota, Maharashtra, India

ABSTRACT: This project presents the overall design of a Classroom Au- tomation System (CAS) with low cost and wireless sys- tem. It specifically focuses on the development of an IOT based classroom automation system that is able to control various components via the internet or be automatically programmed to operate from ambient conditions. In this project, we design the development of a firmware for smart control which can successfully be automated minimizing human interaction to preserve the integrity within whole electrical devices in the classroom. We used Node MCU, a popular open-source IOT platform, to execute the pro- cess of automation. Different components of the system will use different transmission mode that will be imple- mented to communicate the control of the devices by the user through Node MCU to the actual appliance. The main control system implements wireless technology to provide remote access from smart phone. We are using a cloud server-based communication that would add to the practi-cality of the project by enabling unrestricted access of the appliances to the user irrespective of the distance factor. We provided a data transmission network to create stronger automation. The system is intended to control electrical appliances and devices in house with relatively low cost design, user-friendly interface and ease of installation. The status of the appliance would be available, along with the control on an Android platform. This system is designed to assist and provide support in order to fulfil the needs of elderly and disabled in classroom. Also, the smart class- room concept in the system improves the standard living at classroom.

I. INTRODUCTION

Internet of Things (IOT) is a concept where each device is assign to an IP address and through that IP address anyone makes that device identifiable on internet. The mechani- cal and digital machines are provided with unique identi- fiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. Basically, it started as the “Internet of Comput-ers.” Research studies have forecast an explosive growth in the number of “things” or devices that will be connected to the Internet. The resulting network is called the “Internet of Things” (IoT). The recent developments in technology which permit the use of wireless controlling environments like, Bluetooth and Wi-Fi that have enabled different de- vices to have capabilities of connecting with each other. Using a WIFI shield to act as a Micro web server for the Arduino which eliminates the need for wired connections between the Arduino board and computer which reduces cost and enables it to work as a standalone device. The Wi-Fi shield needs connection to the internet from a wire-less router or wireless hotspot and this would act as the gateway for the Arduino to communicate with the internet. With this in mind, an internet based classroom automa- tion system for remote control and observing the status of classroom appliances is designed. Due to the advancement of wireless technology, there are several different type of connections are introduced such as GSM, WIFI, and BT. Each of the connection has their own unique specifications and applications. Among the four popular wireless con- nections that often implemented in HAS project, WIFI is being chosen with its suitable capability. The capabilities of WIFI are more than enough to be implemented in the de- sign. Also, most of the current laptop/notebook or Smart- phones come with built-in WIFI adapter. It will indirectly reduce the cost of this system

II. LITERATURE REVIEW

IOT BASED HOME AUTOMATION SYSTEM: This project explores home automation using the Internet of Things (IoT). It involves integrating various devices and appli- ances within a home to create an interconnected system. The study covers topics such as specifications, pin defini- tions, and programming with Arduino IDE. It also delves into flashing NodeMCU firmware on the ESP8266, which is a popular microcontroller for IoT projects.

Smart Home Automation: Smart home technology, now integrated into the IoT, provides homeowners with peace of mind by allowing them to monitor and protect their houses remotely. This research study provides a comparative lit- erature review on smart home automation, emphasizing its benefits and applications.

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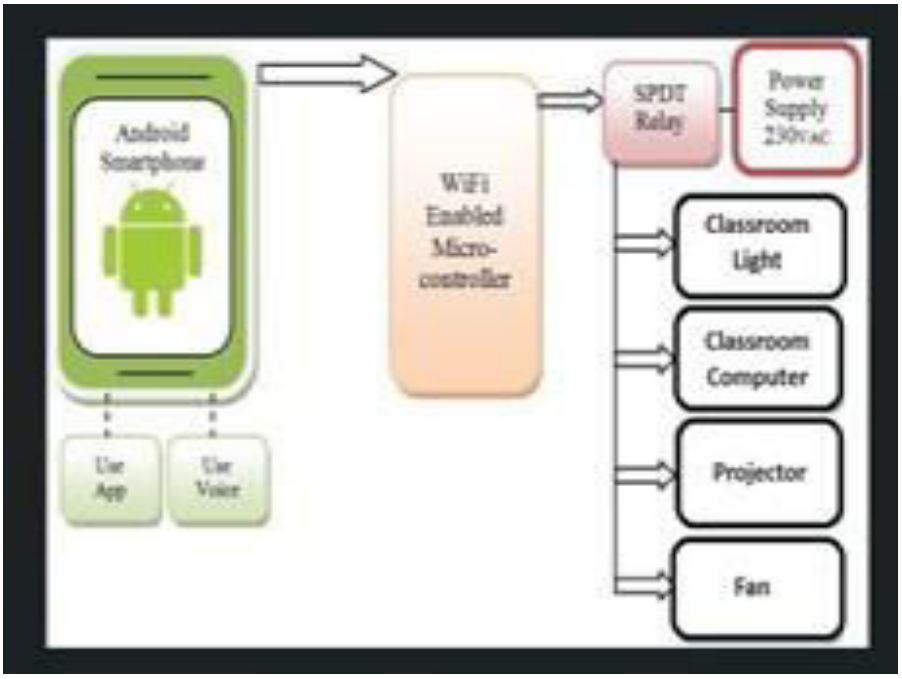
Communication Methodologies: Various communication methods are explored, including GSM, Wi-Fi, IoT, and Bluetooth. The pros and cons of each technique are dis- cussed, along with their features.
Overall Study: The overall study of new technologies used for home automation is presented. Key terms includeApple Home Kit, Amazon Echo, Google's Nest Thermo- stat, IFTTT, Belkin's Wemo Switch, and Blynk App. **Ad-vantages of Home Automation:** Home automation refers to the remote monitoring and control of appliances. With the continuous growth of the Internet, this field continues to evolve.

III. SYSTEM ARCHITECTURE



IV. EXPERIMENTAL METHODOLOGY

Node MCU is the microcontroller unit in the prototype. It has an in built Wi-Fi module (ESP8266) that establishes wireless remote switching of classroom appliances.

Four channel relay module consists 4 individual relays physically connected between Node MCU and the class- room appliances. It takes signals form GPIO pins of Node MCU and accordingly connects or disconnects classroom appliances from the supply. They act as the switching de- vice.

LED and resistors are used in this prototype to replace real appliances. They indicate power being turned on and off to the appliances. In real time operation they would bereplaced by actual classroom appliances.

Android application was designed for the Internet of Things.It can control hardware remotely, it can display sensor data, it can store data, visualize it, etc. the prototype primarily uses android application to sense commands from user to the hardware over wireless network.

Google assistant is a system software present on the an- droid phone. It interprets the voice commands by the user to turn on or off an appliances.

IFTTT application the voice commands interpreted by the google assistant isn't understandable by Android ap- plication thus unable to send to the hardware. IFTTT is an intermediate application that interprets commands from Google assistant and sends on and off signal to Android application Via Cloud server.

NodeMCU (Node Microcontroller Unit) is a low-cost open source IOT platform. It initially included firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Sys- tems, and hardware which was based on the ESP-12 mod-

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ule. Later, support for the ESP32 32-bit MCU was added NodeMCU is an open source firmware for which open source prototyping board designs are available. The name "NodeMCU" combines "node" and "MCU" (micro-controller unit). The term "NodeMCU" strictly speaking refers to the firmware rather than the associated development kits. Both the firmware and prototyping board designs are open source. The firmware uses the Lua scripting language. The firmware is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua- cjson and SPIFFS. Due to resource constraints, users need to select the modules relevant for their project and build a firmware tailored to their needs. Support for the bit ESP32 has also been implemented. The prototyping hardware typically used is a circuit board functioning as a dual in-line package (DIP) which integrates a USB con- troller with a smaller surface-mounted board containing the MCU and antenna. The choice of the DIP format al- lows for easy prototyping on breadboards. The design wasinitially was based on the ESP-12 module of the ESP8266, which is a Wi-Fi SoC integrated with a Tensilica Xtensa LX106 core, widely used in IOT applications.

Pin Configuration of Node MCU Development Board Thismodule provides an access to the GPIO subsystem. All the access is based on I/O index number of Node MCU kits, not the internal GPIO pins. For example, the D0 pin on the development kit is mapped to GPIO pin 16. Node MCU provides access to the GPIO pins and the following pin mapping table is a part of the API documentation.

The ESP8266 Node MCU has total 30 pins that interface it to the outside world. The pins are grouped by their func- tionality as:

Power pins: There are four power pins viz. one VIN pin
three 3.3V pins. The VIN pin can be used to directly sup- ply the ESP8266 and its peripherals, if you have a regulated 5V voltage source. The 3.3V pins are the output of an on-board voltage regulator. These pins can be used to supply power to external components.

GND: is a ground pin of ESP8266 Node MCU develop- ment board.

12 IC Pins: are used to hook up allsorts of I2C sensors andperipheralsin your project. Both I2C Master and I2C Slaveare supported. I2C interface functionality can be realized programmatically, and the clock frequency is 100 kHz at a maximum. It should be noted that I2C clock frequency should be higher than the slowest clock frequency of the slave device.

GPIO Pins: ESP8266 Node MCU has 17 GPIO pins which can be assigned to various functions such as I2C, I2S, UART, PWM, IR Remote Control, LED Light and Button pro- grammatically. Each digital enabled GPIO can be config- ured to internal pull-up or pull-down, or set to high impedance.When configured as an input, it can also be set to edge- trigger or level-trigger to generate CPU interrupts.

ADC Channel: The Node MCU is embedded with a 10- bit precision SAR ADC. The two functions can be imple- mented using ADC viz. Testing powersupply voltage of VDD3P3 pin and testing input voltage of TOUT pin. How-ever, they cannot be implemented at the same time.

UART Pins:ESP8266 Node MCU has 2 UART interfaces,
i.e. UART0 and UART1, which provide asynchronous com- munication (RS232 and RS485), and can communicate at up to 4.5 Mbps. UART0 (TXD0, RXD0, RST0 CTS0 pins) can be used for communication. It supports fluid control. However, UART1 (TXD1 pin) features only datatransmit signal so, it is usually used for printing log.

SPI Pins: ESP8266 features two SPIs (SPI and HSPI) in slave and master modes. These SPIs also support the fol- lowing general-purpose SPI features: • 4 timing modesof the SPI format transfer • Up to 80 MHz and the di- vided clocks of 80 MHz • Up to 64-Byte FIFO SDIO Pins: ESP8266 features Secure Digital Input/output Interface (SDIO) which is used to directly interface SD cards. 4-bit 25 MHz SDIO v1.1 and 4-bit 50 MHz SDIO v2.0 are supported.

PWM Pins: The board has 4 channels of Pulse Width Modulation (PWM). The PWM output can be implemented programmatically and used for driving digital motors and LEDs. PWM frequency range is adjustable from 1000 s to 10000 s, i.e., between 100 Hz and 1 kHz.

Control Pins: are used to control ESP8266. These pins in-clude Chip Enable pin (EN), Reset pin (RST) and WAKEpin. • EN pin – The ESP8266 chip is enabled when EN pin is pulled HIGH. When pulled LOW the chip works at minimum

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power. • RST pin – RST pin is used to reset theESP8266 chip. • WAKE pin – Wake pin is used to wake the chip from deep-sleep.

Installation of Node MCU: Mostly these days devices download and install drivers on their own, automatically. Windows doesn't know how to talk to the USB driver on the Node MCU so it can't figure out that the board is a Node MCU and proceed normally. Node MCU Amica is an ESP8266 Wi-Fi module based development board.It has got Micro USB slot that can directly be connectedto the computer or other USB host devices. Ti has got 15X2 header pins and a Micro USB slot, the headers can be mounted on a breadboard and Micro USB slot is to es- tablish connection to USB host device. It has CP2120 USBto serial converter. In order to install CP2120 (USB to se-rial converter), user is needed to download the driver for the same. Once user downloads drivers as per its respec- tive operating system, the system establishes connection to Node MCU. The user needs to node down the COM post allotted to newly connected USB device (Node MCU) from device manager of the system. This com port num- ber will be required while using Node MCU Amica. As the CP2120 driver is been installed, the Node MCU can be programmed using Arduino IDE software by coding inembedded C. this requires ESP8266 board installation in Arduino IDE from board manager, and assigning commu-nication port.

V. IMPLEMENTATION

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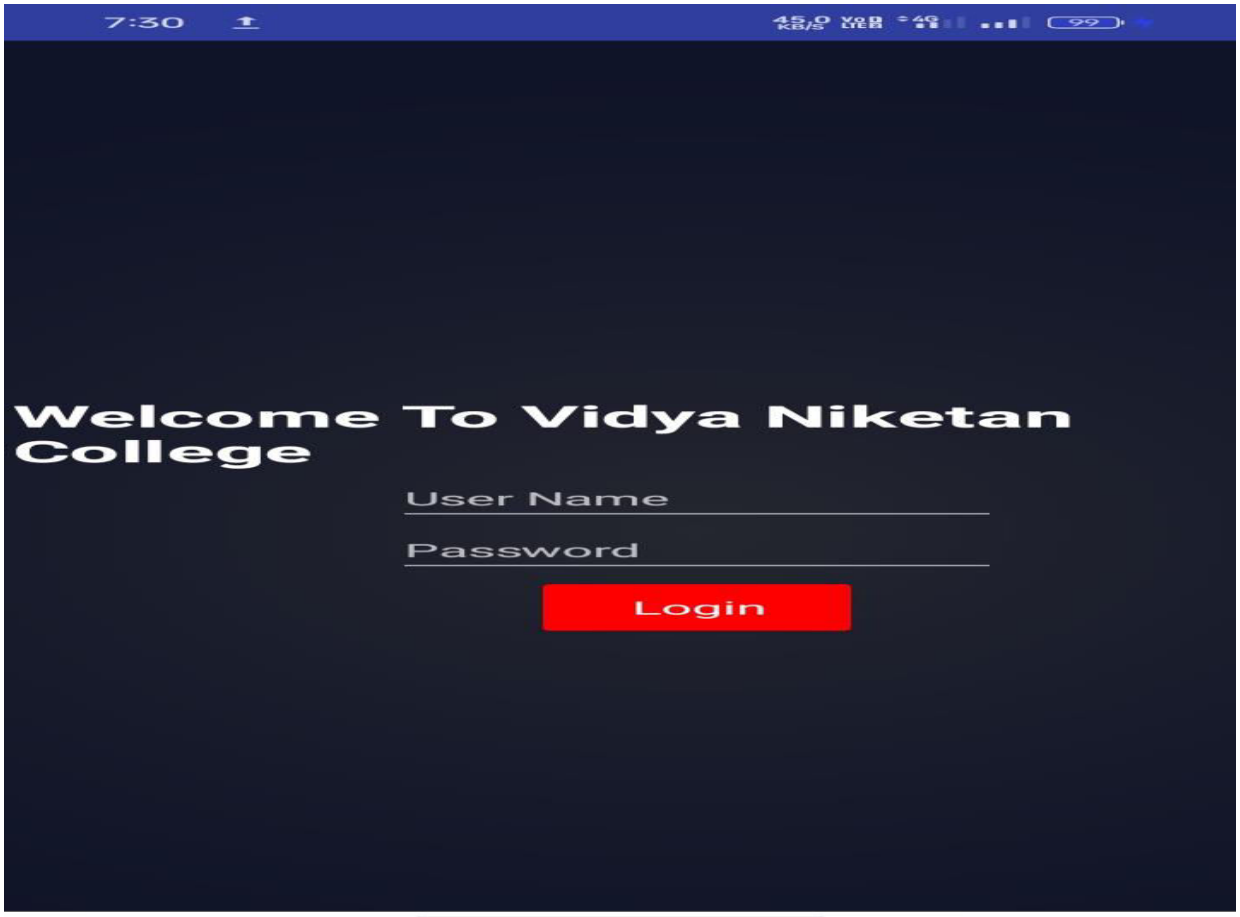

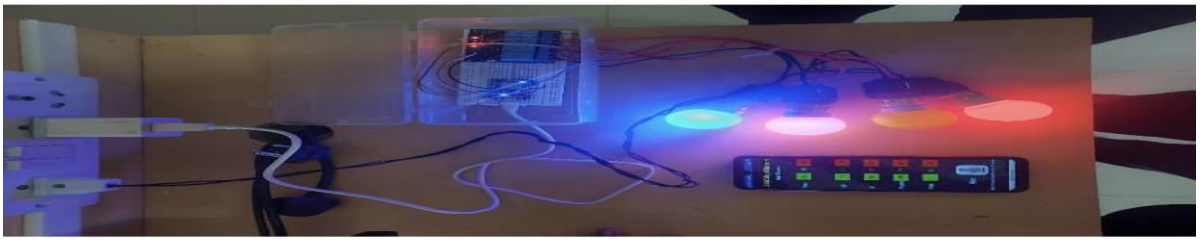

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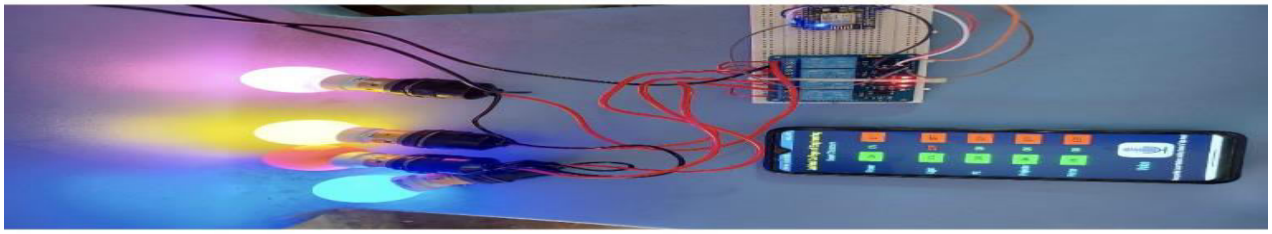

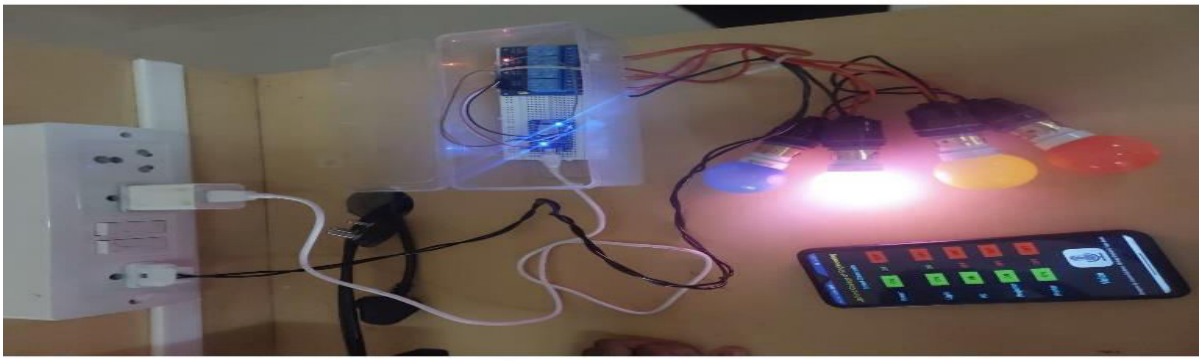

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VI. CONCLUSION

It is evident from this project work that an individual con-trol classroom automation system can be cheaply made from low-cost locally available components and can be used to control multifarious classroom appliances ranging from the security lamps, the projector to the computer sys-tem and even the entire classroom lighting system. And better still, the components required are so small and few that they can be packaged into a small inconspicuous con- tainer. The designed classroom automation system was tested a number of times and certified to control differ- ent classroom appliances used in the lighting system, com- puter system, projector system and many more. Hence, this system is scalable and flexible. Android devices hav- ing a lower API version than 16 require internet access to convert the speech data to string data. Currently, the ap- plication is made for Android smartphones; other OS plat- form don't support our application. During voice mode, external noises (voice) may affect our result. The speech instruction that we command in our voice mode may not give exact results as expected. There hence lies an ambi- guity in the result.

REFERENCES

1. "Smart Energy Efficient Home Automation Systemusing IOT", by Satyendra K. Vishwakarma, PrashantUpadhyaya, Babita Kumari, Arun Kumar Mishra.
2. "IOT Based Smart Security and Home Automation", by Shardha Somani, Parikshit Solunke, Shaunak Oke, Parth Medhi, Prof. P. P. Laturkar.
3. "A Dynamic Distributed Energy Management Al- gorithm of Home Sensor Network for Home Au- tomation System", by Tui-Yi Yang, Chu-Sing Yang,Tien-Wen Sung; in 2016 Third International Confer-ence on Computing Measurement Control and Sen-sor Network.
4. "Enhance Smart Home Automation System based
5. on Internet of Things", by Tushar Churasia and Prashant Kumar Jain; in Proceedings of the Third Interna- tional Conference on I-SMAC (IoT in Social, Mo- bile, Analytics and Cloud) (I-SMAC 2019) IEEE Xplore Part Number:CFP19OSVART; ISBN:978-1-7281-4365- 1.
6. "Visual Machine Intelligence for Home Automation", by Suraj, Ish Kool, Dharmendra Kumar, Shovan Bar-man.
7. "A Low Cost Home Automation System Using Wi- Fi based Wireless Sensor Network Incorporating in-
8. ternet of Things", by Vikram.N, Harish.K.S, Nihaal.M.S, Raksha Umesh, Shetty Aashik Ashok Kumar; in 2017 IEEE 7th International Advance Computing Confer- ence.
9. . "Voice Controlled Home Automation System using Natural Language Processing and Internet of Things", by Mrs. Paul Jasmin Rani, Jason Bakthakumar, Praveen Kumaar.B, Praveen Kumaar.U, Santhosh Kumar; in 2017 Third International Conference on Science Tech- nologyEngineering and Management (ICONSTEM).
10. Wikipedia(2009). HomeAutomation. From https://en.wikipedia.org/wiki/Homeautomation.
11. Theory of IOT from https://internetofthingsagenda.techtarget.com/definition/Internet- of-Things-IoT.
12. About Node MCU from: https://lastminuteengineers.com/esp8266- nodemcu-arduino-tutorial/ .

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