Smart Classroom using Raspberry Pi

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Abstract - Presently automation using IOT has become the major attraction and is thriving everywhere, here we are trying to control the home appliances and entertainment systems using internet and the google assistant. The main peep of this project along with automation is the usage of Google Assistant, where we are inducing the technology into the simple voice mechanism. The backbone of this project is Raspberry pi. Smart classroom using Raspberry pi is very simple and an effective user interface. It eases the user to control the device effortlessly and successfully. The project will reach most of the people expectation as it is controlled only via voice where we don't even have to touch it. And coming to the class room automation it is everyone’s favourite. We found designing and developing this interactive project very interesting and a good learning experience

Keywords—Automation, Internet, Google Assistant, Raspberry pi

I. INTRODUCTION
There is always an eye on and use of Automation in various fields. It gives a very flatten control on electronic devices. Virtual Assistant is often coming into picture, and is taking the technology to different level. We find Virtual Assistant in most of the electronic applications like smartphones, computers, TV etc. Internet of Things is the idea of commonplace objects – from engineering machines to wearable devices – using in-built sensors to accumulate data and take action on that data across a network. To put it in simple words, “Internet of Things” is the upcoming technology that can make our lives more effective. Devices that were utilized on a grander scale for decades, but it’s only been in the past several years that we’ve seen the IoT’s true potential. As concept grew wireless Internet became more universal, embedded sensors grew in superiority and people began accepting that technology could be a personal tool as well as a professional one. The main inspiration behind this project is to bring out the new ways of interaction between the individual and the technology implemented in the classroom. It will make learning striking and easier.

II. SYSTEM DESIGN
Smart classroom is composed of two controller, L293D motor driver IC, stepper motor, relay, DHT11. The system block diagram is shown in figure 1.

A. Controller module
The controller is the "brain" of the smart classroom, which ensures the normal operation of the smart classroom parts.

Raspberry pi- It encompasses of 1.2GHz Broadcom BCM2837 64bit processing unit, RAM of 1GB, wireless LAN- BCM43438 and Low Energy Bluetooth on board, Ethernet base 100, GPIO pins - 40, 4 USB 2 ports and micro port for loading your operating system and storing data.

Arduino – A microcontroller board built on the ATmega328. It is an open-source, prototyping stage. The Arduino Uno consists of 14 digital input/output pins in which 6 can be used as PWM pins, 6 analog inputs pins, one crystal oscillator of 16 MHz, one USB connection, jack for power supply, ICSP header, and a button for reset.

B. Stepper Motor(NEMA17)
This bipolar four wired stepper has 1.8 degree rotation per step for smooth motion and adequate holding torque. Motor has a capability to hold maximum current of 350mA so that it could be driven smoothly with an L293D driver component for Arduino and a wall adapter or lead-acid battery [4]. Few details include a ready-to-go cable and a machined drive shaft.

C. Google Assistant API
Google Assistant software development kit allow you to add hotword detection, voice control, natural language understanding and Google’s smarts to your thoughts [1]. Project identifies a note, directs it to the Google Assistant, and accepts a spoken audio response in addition to the text of the spoken word [2]. The library reveals a high level, event-based API that is easy to extend. It provides the following features out of the box:

D. Motor driver module (L293D)

L293D holds two intrinsic H-bridge driver circuits. Action in its common mode, concurrently two DC motors can be driven, in clockwise as well as anticlockwise trend. The actions of two motors can be owned by input logic at pins two, ten, seven and fifteen. Input logic 11 or 00 will stop the relative motor. Logic 10 and 01 will rotate it in anticlockwise and clockwise directions, independently. Pin diagram is shown in figure 2.

E. IFTTT

All the services has its own actions with a particular set of triggers. Triggers are "this" part in an applet [8]. They are used to trigger the action. Actions are "that" part in an applet. They are the output for the given input trigger.

F. Particle IDE

Particle is a stage for interacting with physical devices. In addition to development tools, particle offers a distributed operating system for the Internet Of Things and also a web IDE that allows us to access the devices wirelessly that brings the power of the cloud to low cost connected hardware.

G. Data Acquisition Module Circuit

Data acquisition module uses smoke sensor, carbon monoxide sensor to detect the environment and transmits the collected info to the microcontroller [5]. Figure 3 is the circuit design of the data acquisition module. Ionization-type smoke alarms have a slight amount of radioactive material between two electrically charged plates, that ionizes the air and causes current to flow between two plates. When smoke enters the chamber, it disturbs the flow of ions, thus decreasing the flow of current and triggering the alarm.
III. DESIGN OF SYSTEM SOFTWARE

Installation of stretch to Raspberry pi

Step 1: Download the stretch image
Step 2: Put your SD card into your computer
Step 3: Use Etcher to burn OS to the SD card
Step 4: Format the SD card
Step 5: Download and launch the Win32 disk manager.
Step 6: Flash the SD card
Step 7: Boot your pi
Step 8: Update and upgrade pi using sudo apt-get update and sudo apt-get dist-upgrade

Raspberry pi program design

Raspberry pi main program is written using C-language. C-language can invoke various Linux operating system software based on network, can get online sharing. Raspberry pi main program flow diagram is shown in figure 5.

Algorithm:
Step 1: Raspberry pi booting up the essential software.
Step 2: Starting the particle software packet in raspberry pi
Step 3: Take voice command form mobile through Google assistant
Step 4: Google assistant will match with the library of input that we have created in Ifttt API
Step 5: Ifttt call the Handel to access the particle API
Step 6: Particle API will Handel the request and will send instructions to raspberry pi through Internet
Step 7: Raspberry pi will execute the instructions and control the specific hardware based on the voice command input
Step 8: Return to step 3 for new input commands
Step 9: Stop when completed and shutdown

Code for Raspberry pi and Arduino

Particle code:

```c
int relay = D0; //pin to which relay is connected
int stepper = D8;
bool vin = LOW;
bool v1 = LOW; //a virtual boolean variable

void setup()
{
  pinMode(relay,OUTPUT); // relay pin is set as output
digitalWrite(relay,HIGH);
  pinMode(stepper,OUTPUT);
digitalWrite(stepper,LOW);
  // Subscribe to events published by IFTTT using
  Particle.subscribe
  Particle.subscribe("Unique_Event_Name",myHandler);
  Particle.subscribe("Unique_Event_Name2",thisHandler);
  Particle.subscribe("Unique_Event_Name3", tHandler);
  Particle.subscribe("Unique_Event_Name4", sHandler);
}
void loop()
{
  if (vin==HIGH)
  {
    digitalWrite(relay,HIGH);
  }
  if (vin==LOW)
  {
    digitalWrite(relay,LOW);
  }
  if (v1==HIGH)
  {
    digitalWrite(stepper,HIGH);
  }
  if (v1==LOW)
  {
    digitalWrite(stepper,LOW);
  }
  //our events are called when IFTTT applets are triggered
  void myHandler(const char *event, const char *data)
  {
    vin = HIGH;
  }
  void thisHandler(const char *event, const char *data)
  {
    vin = LOW;
  }
  void tHandler(const char *event, const char *data)
  {
    v1 = HIGH;
  }
  void sHandler(const char *event, const char *data)
```

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Arduino code:

```cpp
#include <Stepper.h>
const int stepsPerRevolution = 400;
int che=2;
Stepper myStepper(stepsPerRevolution, 12, 11, 10, 9);

void setup()
{
  pinMode(che,INPUT);
  myStepper.setSpeed(60);
  Serial.begin(9600);
}

void loop()
{
  int qwt=digitalRead(2);
  Serial.println(qwt);
  if(qwt==HIGH)
  {
    Serial.println("clockwise");
    myStepper.step(stepsPerRevolution);
    delay(500);
  }
  else if (qwt==LOW)
  {
    Serial.println("counterclockwise");
    myStepper.step(-stepsPerRevolution);
    delay(500);
  }
}
```

IV. SYSTEM DESIGN IMPLEMENTATION

The acute perseverance of implementing this project is to convey out the new ways of collaboration among the individual and the technology. The development will reach most of the anticipation as it is controlled via voice where we don’t even have to touch things, so which is easy and saves energy [6]. The appliances and other systems generally used in households and organization will be able to manage. Households and organizations are consuming much power today than industries and businesses. Figure 4 shows the basic working of the project, here the backbone is Raspberry Pi which acts as a regulator in which the Particle API is been installed, which inturn helps the Raspberry Pi to control appliances like lighting, fan, projectors through voice commands. Initially, voice commands are given through cell phone using Google assistance, Google assistance evokes the IFTTT applets then certain conditional statements is sent to particle IDE, particle IDE uses c programming language to flash raspberry pi wirelessly via web IDE. The lights, fans, and projectors are controlled using the commands like “TURN ON LIGHTS”, “TURN OFF LIGHTS”, these commands are verified by particle IDE and corresponding actions are carried by relay. Commands such as “SCREENS OPEN”, “SCREEN CLOSE” “, these commands are verified by particle IDE and corresponding actions are controlled by Raspberry Pi and Arduino through Stepper motor [7], stepper will be loaded with particular set of rotations via code. When the projector “TURN ON or OFF” function is performed simultaneously there will be multiple actions taking place like switching off the lights, closing of window screens and opening of projector screen. The DHT11 sensor senses the temperature and if the room temperature is greater than 27 degree fans will automatically turns on. Smoke sensor detects the smoke and automatically turns on the fan and open the window.

V. CONCLUSION

It has a very simple and an effective user interface. It eases the user to control the device effortlessly and effectively. As mentioned in the beginning the focus is on classroom automation, a classroom automation is what future technology should look like. The project will reach most of the people expectation as it is controlled only via voice where we don’t even have to touch things, We found designing and developing this interactive project very interesting and a good learning experience. Here we are integrating Google assistance SDK (Software Development Kit) with using any third party application by manipulating source code. Voice control of GPIOs with IFTTT, API.AI, Actions SDK. Voice control of servo, connected to Raspberry Pi. Safe shutdown of Raspberry Pi using voice command. Remote class monitoring system using camera, Attendance statistics report using raspberry pi

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