IJIREEICE ISSN (O) 2321-2004, ISSN (P) 2321-5526

International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering

Impact Factor 8.021 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 12, Issue 5, May 2024

DOI: 10.17148/IJIREEICE.2024.12509

AI Based Chatbot for Appliance Control

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Abstract: Home automation is the automated control of electrical equipment in a house, facilitated by internet connection. These devices can be remotely managed using voice assistants or apps, reducing the need for manual operation. Home automation can control lighting, air conditioning, and temperature settings, thereby reducing energy, heating, and cooling costs. Additionally, it enhances security by using Internet of Things devices like cameras, thereby reducing the risk of accidents. In current scenario ,with the advent of smart home technology, the integration of chatbots for controlling appliances has gained significant attention. This paper presents a chatbot-based appliance control prototype that has features similar to artificial intelligence. The current platform Chatfuel, which enables users to create chatbots from scratch and host them on any social network of their choice such as Facebook Messenger, is used to give the chatbot AI-like features. In addition, a cloud platform Adafruit Io is used to connect the hardware setup including NodeMCU to the internet easily and manage them remotely, allowing users to collect, visualize, and analyse live data streams in the cloud from their devices. IFTTT which is web service is used in the proposed prototype to automate interactions between Chatfuel and the Adafruit IO.

Keywords: Smart homes, Chatbots, Appliance Control, Artificial Intelligence, Facebook Based Chatbots , IFTTT , Adafruit IO

I. INTRODUCTION

Home automation systems have become a go-to arena in recent years. Home automation with chatbot applications allows users to control electric home appliances over the internet using the Internet of Things (IoT), thus increasing efficiency and ease of use. This seamless integration eliminates the need for complex manual controls or multiple mobile apps, providing a convenient and efficient way for users to manage their smart devices. The theme of this project is to design a chatbot with artificial intelligence and IoTto control home appliances from anywhere, anytime. This research work designs a chatbot for an existing platform. With the advent of smart phones,more people are connected to social networks, so why not shift the control ofdevices to a simple chat on a chatbot to perform the task?

The proposed prototype in the paper aims to design a chatbot with artificial intelligence and IoT to control home appliances from anywhere, anytime. With the rise of smart phones and social networks, the control of devices can be shifted to a simple chat on a chatbot. The prototype uses the Adafruit MQTT broker for communication among devices, the IFTTT service for configuration, and Chatfuel for creating a simple chatbot. The IoT automation concept is implemented, with the chatbot acting as an interface. A command is given to the chatbot, which is then sent as a signal to the controlling board, which controls the devices referred to in IoT. Combining these techniques allows for unlimited remote access to devices. At the output load, a LED Bulb and a DC fan is provided to demonstrate the controlling of appliances using Facebook Messenger. The user can interact with the chatbot through Facebook Messenger to turn on or off the LED bulb and DC fan remotely. This showcases the practical application of IoT automation in a user-friendly interface.

II. LITERATURE SURVEY

Survey of different appliance control system shows that there are various kinds of technologies used to implement the similar architecture. Various smart systems have been proposed and consist of different technologies andappliances.

A. *Implementation of Home Automation Using Chatbot*

In [1], the concepts of IoT, Natural language processing (NLP) and chatbot are put together to provide a simple home automation system. The authors have used, Node MCU, led bulb and Relay Module for the execution along with the

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software, the Telegram Bot is used as a user interface which gets connected through the Wi-Fi and power supply.The user is allowed to control the bot with the help of Hypertext Transfer Protocol Secure request (HTTPS) to our own Bot Application Programming Interface (API).The Telegram Bot processes the input text request using the NLP module in the Node MCU and then the response is given back in the form of text through the Telegram Bot.

B. *Controlling Home Appliances Adopting Chatbot Using Machine Learning Approach*

In this proposed system [2], users can control and monitor the home environment by using an android application. The Android based home application communicates with the Raspberry Pi 3 via the internet using chatbot.The system can extract the device name such as light, fan, etc using synonyms by utilizing Jaro-Winkler string matching algorithms. The project also used the Naive Bayes algorithm to take command for action. A Firebase-based system connects the users and controls hardware. The model can control the home appliances from a long distance because of the wireless fidelity system.

C. *Home Automation System using Google Assistant*

In [3], the authors have used the voice commands for Google assistant that have been added through IFTTT website. In this home automation, as the user gives commands to the Google assistant, Home appliances like Bulb can be controlled accordingly. The device connected to the respective relay can be turned ON or OFF as per the users request to the Google Assistant. The microcontroller used is NodeMCU (ESP8266) and the communication between the microcontroller and the application is established via Wi-Fi (Internet).

D. *Home Automation using AI*

The paper contains the Virtual Google Assistant from google, the IFTTT web application, the Blynk application and the NodeMCU microcontroller as the major components. Natural language voice is employed to offer commands to the Google Assistant. [4].

III. SYSTEM ARCHITECHTURE

For the prototype, a Facebook page is to be created for appliances and Chatfuel Platform is used to program the Page which enables to streamline automated conversations effectively. IFTTT (If This Then That) service is used to configure our AI.The commands given as text on chatbot are acceptedby IFTTT and the corresponding data is sent to Adafruit Cloud. For microcontroller NodeMCU ESP8266 12E is used which have an inbuilt Wi-Fi support. The Adafruit communicates with NodeMCU by MQTTProtocol. At last,the relay module controls the switching status of the appliances.

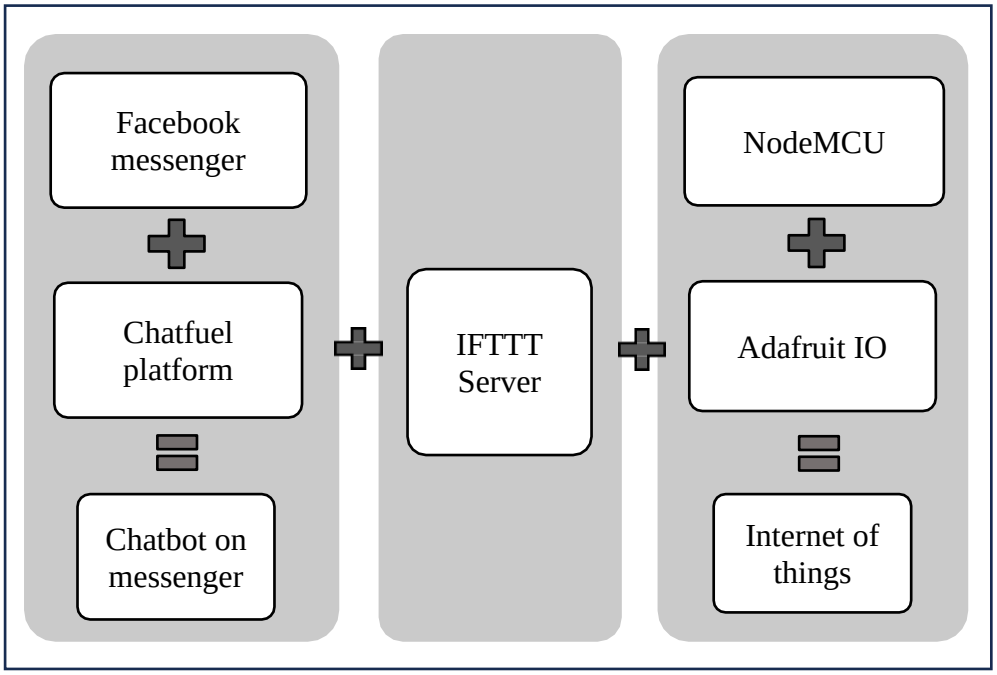

Fig 1. System Architecture

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IV. HARDWARE & BACKEND SETUP

The proposed system is bifurcated into hardware and backend setup. In the proposed project, Node MCU plays a major role of controlling the internet.Node MCU board is correctly linked to the ChatBot and those configurations are correctly coded in the Arduino IDE. For the user interface, a Facebook page is to be created for appliances and Chatfuel Platform can be used to program the Page which enables to streamline automated conversations effectively.IFTTT (If This Then That) service can be used to configure our AI.The commands given as text on chatbot can be accepted by IFTTT and the corresponding data will be sent to Adafruit Cloud.For microcontroller NodeMCU ESP8266 12E is to be used which have an inbuilt Wi-Fi support on the backend side,the Adafruit communicates with NodeMCU by MQTT Protocol.At last,the relay module can control the switching status of the appliances.

A. *Hardware Setup*

The Hardware Design of the project includes NodeMCU microcontroller with in-built WiFi support.A 5V relay can be used for switching appliances.NodeMCU is the heart of the project. It is the cheapest available microcontroller with inbuilt Wi-Fi support running on ESP8266, open source platform for developing IoT projects. It integrates GPIO, PWM, IIC and ADC all in one board. GPIO (General Purpose Input Output) pins are used for connecting the relay.5V relays can easily be used for switching home appliances. And NodeMCU also requires 5V DC supply to function.

The 2-Channel Relay is controlled with D3 and D4 of NodeMCU. The NodeMCU cannot supply enough output current to drive a heavy load like bulb,motor, alarm etc. Hence, an external 5V power supply is provided to Vin pin of NodeMCU which converts the 220V AC into 5V DC. The D3 & D4 pins of nodemcu are given to IN1 & IN2 pins of 2-Channel Relay. As the relay produces 5V output,it is enough to control the DC fan at the output load,hence an external 12V supply is given. For the hardware setup,below given is the circuit diagram of the system.

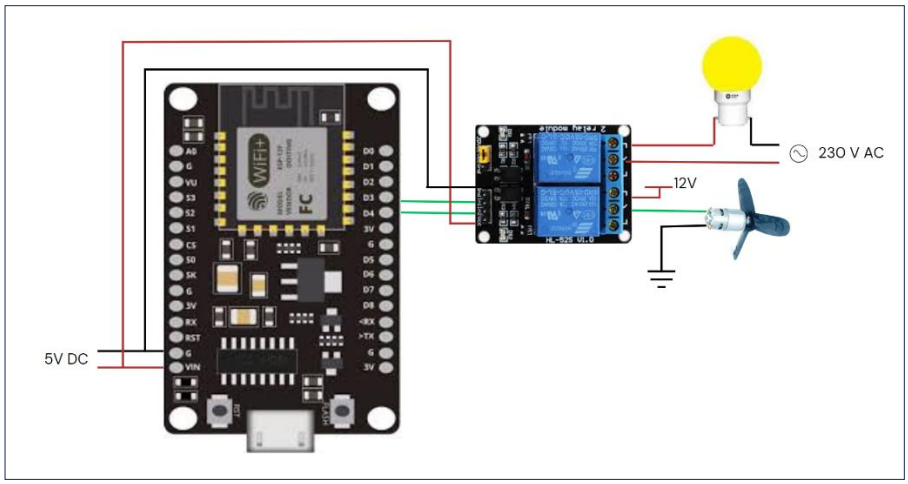

Fig. 2. Circuit Diagram of the system

B. *Backend Setup*

The proposed work aims to shift the access to control your appliances to yoursocial networks. For the prototype,a chatbot is to be created using Chatfuel Platform which will be integrated with Facebook Messenger. The service of Chatfuel is used to program the page with its inbuilt features. To configure the AI rules, IFTTT and Adafruit IO can be used as a backend support.

1) Chatfuel Setup:

We need a Virtual human to chat with. For this, we will create a Facebook Page. A Facebook Page is created for the appliances and the service of Chatfuel is used to program the page. To start with AI part of chatbot , in “Dashboards” section of chatfuel, create a blank bot and connect your facebook page.To provide automated responses to your chatbot, chatfuel provides some in-built AI type features like blocks and keywords in “Automate” section of chatfuel. Blocks are the functions that will be executed on chat commands. Each Block is a message or a configured bot action. Here, four blocks are added to switch on and switch off light as well as fan (Appliance on/off and Fan On/Off). In each Block ,add a text card response as shown in the figure to acknowledge the command given by user. These text cards are a reply that our Chatbot gives on performing this certain block. These functional blocks will hit the APIs of IFTTT server. In the keywords section, we need to write all the permissible phrases a user can say in corresponding blocks,like “Switch on the Light”, “Turn Off the Fan”, “Light ON”, “Fan OFF”,etc and many more. As shown in the figure below.

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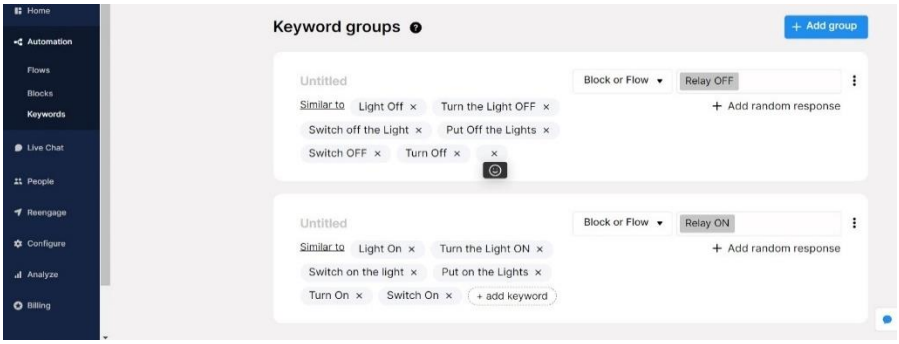

Fig. 3. Keywords Function in Chatfuel

2) *Adafruit IO:*

Adafruit IO server is the IoT end. Here our ESP8266 gets connected with its server and executes our desired command. Here, two feeds are created for fan and light which displays the continuous activity status of the the light and the fan.In dashboard section, a toggle switch is added to visualize the On & Off status of the light and the fan as shown in the figure below.

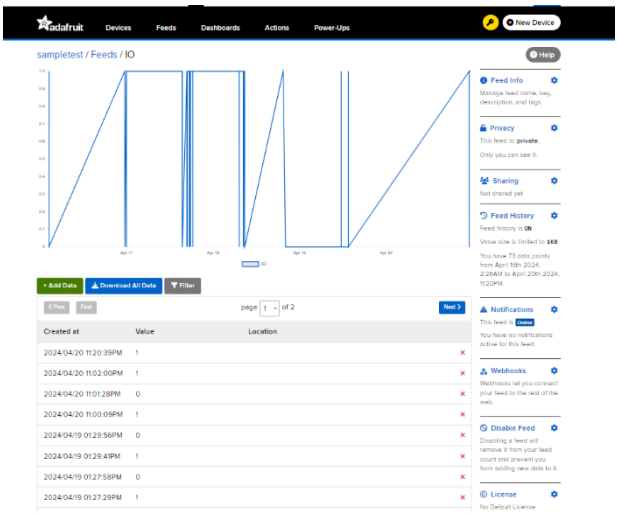

Fig. 4. Feeds and Dashboard Display

3) *IFTTT:*

If This Then That, also known as IFTTT is a freeware web-based service that creates chains of simple conditional statements, called applets. An applet is triggered by changes that occur within other web services such as Gmail, Facebook, Telegram or other social networks. IFTTT pairs two different services/devices so that they can communicate with each other. Here, we are creating an applet by choosing Webhooks as trigger service and Adafruit IO as action service.The Webhooks is used as a trigger service to receive a web request and Adafruit IO is used as an action service.In the action field,the respective feeds which were created for Fan and Light are selected,so that whenever the webhooks receives a web request as a trigger it,the Adafruit will perform the action defined in the action field,thus sending the corresponding data to the Adafruit Io server.Thus the conditional statement at the IFTTT is created.After the setup,the IFTTT will provide an webhook URL which is added to the chatfuel plugins section of Chatfuel Platform. By doing so, whenever a command is given in Chatfuel Chatbot, the JSON API plugin will send a HTTP request using the webhooks URL provided,This will trigger the IFTTT applet created and activate the action service Adafruit to send data to the OnOFF Feed and IO Feed in our Adafruit IO.The below Fig. 4. Shows the integration of Webhooks URL in the corresponding blocks created at chatfuel which are defined in the chatfuel plugins.

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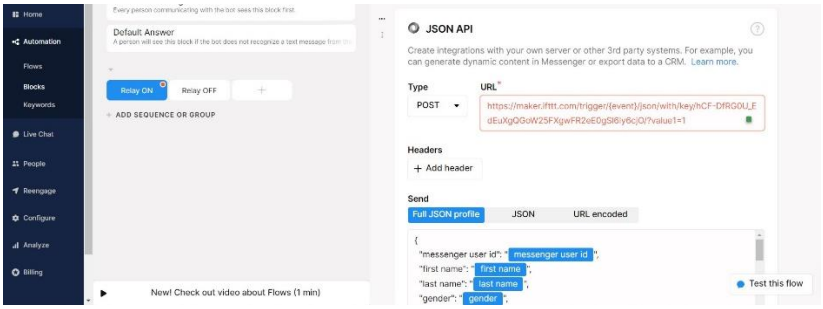

Fig. 4. Integrating IFTTT with Chatfuel Plugins

4) Arduino IDE:

To Program the NodeMCU , Arduino IDE is used . Arduino IDE does not contain support of ESP8266 family. From preferences ESP8266 board package is installed and NodeMCU 1.0 (ESP 12E) module is selected as the preferred board. Adafruit MQTT Library is also included. An ESP8266 Wi-Fi client class is created by passing in the login and server details for MQTT server secure client access. Feeds are defined for MQTT paths in the form <username>/feeds/<feedname>. A feed may be defined for publishing values or for subscribing to a certain topic.

V. IMPLEMENTATION

The below figure shows the block diagram of the system and the flow structure of how the system is operating.

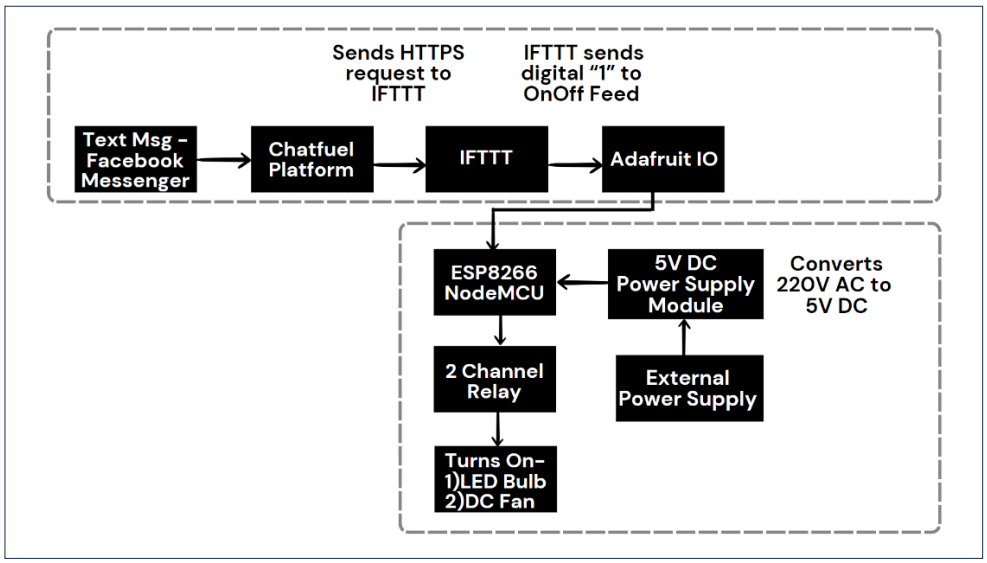

Fig. 6. Block Diagram of the System

As discussed in the previous sections, to begin with, a Facebook page is created for the appliances and the service of Chatfuel is used to program the page. With few AI rules it is possible to make an autonomous chatbot which can respond and send http request to IFTTT platform. The web hook service on IFTTT is used to accept the request and send corresponding data to Adafruit cloud.

Chatfuel on receiving command from Facebook " Light ON" or "Fan ON", would send a post type http request to IFTTT using the JSON API. In this project MQTT is used as a message transfer binding protocol. MQTT consists of broker and client. A client is denoted as a subscriber or publisher to/of a certain topic. A subscriber listens to the server whereas a publisher sends value to the server. For the prototype Adafruit service is used as MQTT broker and NodeMCU as the client. Adafruit provides the cloud platform and a control dashboard as well. While programming the client, subscriber and publisher are defined. Here, NodeMCU is the heart of the project , the D3 & D4 pin of nodemcu is defined for the output to turn on the

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light and the fan respectively.As the D3 pins status changes to high,it drives the relay circuit and the relay being an electromechanical switch turns on the apppliances.

The below figure (Fig. 7) shows corresponding response generated at the chatbot interface on the Facebook messenger.The Fig.8. shows the Hardware module of the system.

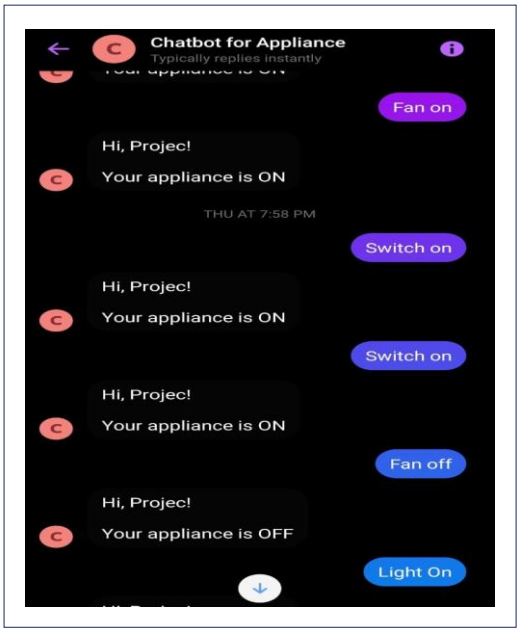

Fig. 7. Chatbot Interface

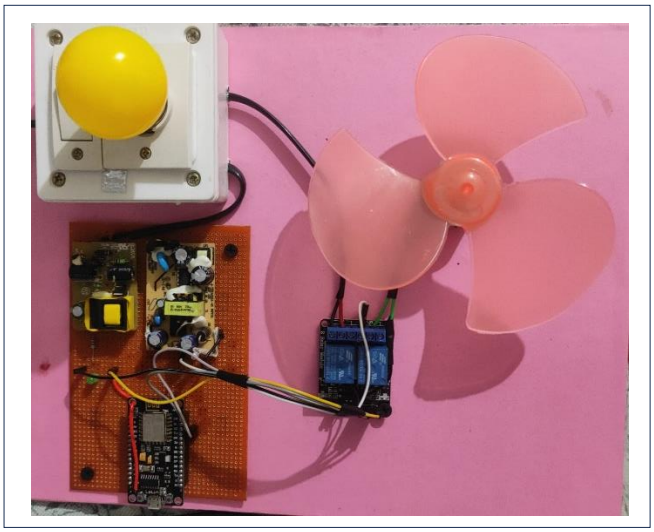

Fig. 8. Hardware Module of the System

VI. FUTURE SCOPE

The system can be further made inclusive of extensions such as attaching ofemail services as an alternate form of message delivery, in situations of utmost importance. The proposed system is based on the inputs in English language, which could further be expanded to accommodate several other regional languages as well.The future healthcare service provider will consider this an effective way ofproviding remote healthcare services, especially to the elderly and disabled who do require intensive healthcare support.In the future, different sensor-based control can also be added with Chatbot. By utilizing sensors we lessen the exertion of proclaiming every single gadget a specific name. If an individual gives an order "bulbs on" the sensor will recognize a particular area and the bulbs will be switched on.

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VII. CONCLUSION

In the proposed work, the system proposed is a smart way of integrating electronic appliances with our daily life. The project implies on using Artificial Intelligence along with the Internet of Things but it also shows an approach to the new world of Social Internet of Things (SIoT), where the potentialities of social networking concepts can be merged with IoT so that aphysical appliance can be integrated directly into a social platform. The resulting paradigm has the potential to support novel applications and networking services for the IoT in more effective, efficient and secure ways.The proposed work aims to enable a real time chat with our appliances suchas Light,Fan or a DC motor over social network from anywhere in the world.With added integrations, the devices will also be able to communicate abouttheir present status with any Artificial Intelligence (AI) of our choice enabling us to create a world where not only humans but devices also have their own social network platform where we can command them to perform certain action just the similar way we would ask a person to do a favour andmonitor them with more efficiency.

In this proposed system, a prototype which can be controlled over the internetthrough Artificial Intelligence of social network like Facebook (Chatbot) andGoogle (Google Assistant) is proposed ,additionally if required we can also switch our choice of AI over the variety available. It also brings an approach towards bridging the gap between social networks (SN) and Internet of Things which enables the connection of people towards ubiquitous automation universe based on Social Internet of Things (SIoT).

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