Home Automation using Artificial Intelligent & Internet of Things

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Abstract. Nowadays home automation is based on the automation process or else the Internet of Things. This paper presents combination of artificial intelligence and the Internet of things-based automation system. Here we develop some fundamental algorithms of artificial intelligence and then integrate them with electronic sensors. The main part of the Internet of Things is a Controller, we are using an Arduino based controller module here. All the sensors used in home automation are in turn connect to this Arduino controller. These Sensors will read the data based on the specifications, then that data will send to the microcontroller to analyze and process and later the Artificial Intelligence starts working as per the data received. Our home appliances start acting depending on the sensor's values obtained. For suppose, if the climate is too cool it will automatically switch OFF the FAN (or) AC. Using AI based face recognition system will operate the doors to close and open, also it can give alerts. By using a water level sensor, we will come to know the water level of the tank, with the help of this ta the motor pump will be ON or OFF according to the values of the water level sensor. And using an MQ-08 sensor the smoke value will be measured in the house, if the smoke value will be HIGH, it may give an alert.

1. Introduction

Home Automation with Artificial Intelligence (AI) aims to use a domestic purpose where the devices are connected and the system can communicate effectively. This is possible through Artificial Intelligence (AI) algorithms that understand, adapt, and personalize themselves based on the performance and behavior of the sensors. The interfacing of AI, into appliances like lights, Fans, security cameras, kitchen gadgets.[9] Homes are converted into automation that can understand and save the routines of their daily habitats. By

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analyzing patterns through AI-equipped sensors these systems can determine when owners are present or absent so that enabling them to adjust the sensors such as temperature control, lighting changes, and security activation. These things not only help conserve energy but also optimize resource utilization [1].

The overall process will be working on Artificial intelligence algorithms that continuously read the data and start working on the automation.[1] The AI system indicates the daily tracking activities, and behavioral patterns in order to proactively adjust settings accordingly. For example, an AI-powered home might anticipate the need for dimmed lighting during evenings and also set the rising temperature based on the owner's requirement[9].
As the sun rises in the morning a coffee maker has an advanced technology-driven element that driven element makes the indication to wake up[9]. When it makes the alarm turn off. The integration of AI has taken security to heights, where cameras, doors, and alarms work together seamlessly [9]. The AI system has the ability to differentiate between faces and potential threats [4].If something unusual happens a notification is immediately sent to the homeowner's smartphone allowing them to monitor their home remotely [9]. Additionally, we prioritize the well-being and safety of individuals. We integrate devices and health sensors into the home network ensuring that caregivers are alerted in case of emergencies or any irregularities, in health conditions [8].

2. Background Work

In homes, IoT technology is used to design the smart and secure for old age people and physically challenged persons. The wireless communication and AI based on the voice commands can control the home appliances easily.[3] Home Automation using Smart Mirror is used to create Magic Mirror. The magic mirror can offer natural modes of interaction by which people can able to control their home appliances and also it as feature like AI chart commands like Google Assistance, WhatsApp (Chatbot). In this we cannot connect any sensors or Microcontrollers directly. It can run uniquely and independently. By using smart mirror provides security and fire alert system.[4] In daily life there is a high demand for electricity if each person can use electricity at homes more effectively and there is a chance to change in climate. By using AI algorithms, we can monitor the ON/OFF status of Home Appliances and also, we can monitor the energy consumption of each appliance at Home.[1] Through the voice assistance we can control the home appliances with IoT and NLP (Natural Language Processing). Best way to interface the IoT and NLP Technology which can control home appliances efficiently. In market there are many smart home appliances which are semi-automated. By using IoT and NLP we can fully automate the home, we can control these appliances like FAN, LIGHT, COFFEE MACHINE and DOOR ALARM etc. [9]

An IoT Based Home Automation system that can monitor home appliances and gadgets. The appliances will connect to the internet through the ESP 8266(Wi-Fi Module). With that, we can monitor the various home appliances like lights, temperature, Humidity, and Fans by using the different sensors [16]. In this Automation, a smartphone controls the different appliances using the panoramic image of the home or which location wants to control with the panoramic image. Panoramic image means 360^0 of our home [17]. With this, we observe that to perform comfort and full security in the owners of a home. This system uses a PIR sensor and vibration sensor to detect the anonymous things going to happen within the house. Also, this sensor network can provide full security from thefts [18]. To design a chatbot with AI and IoT to control home appliances. Raspberry Pi is the

brain of the chatbot with the interface a sensors like PIR, Gas, and Pi cam. A Pi cam will communicate the Telegram cloud that is connected to the home appliances. With the AI commands the home appliances will operate [19].

3. Methodology

The bellow figure explains the overall working of Home Automation. From that, the main microcontroller (Arduino UNO) will control the connected sensors with the inputs taken from the sensors that all will be controlled with Artificial Intelligence. Firstly, the Temperature sensor is connected to Arduino UNO.
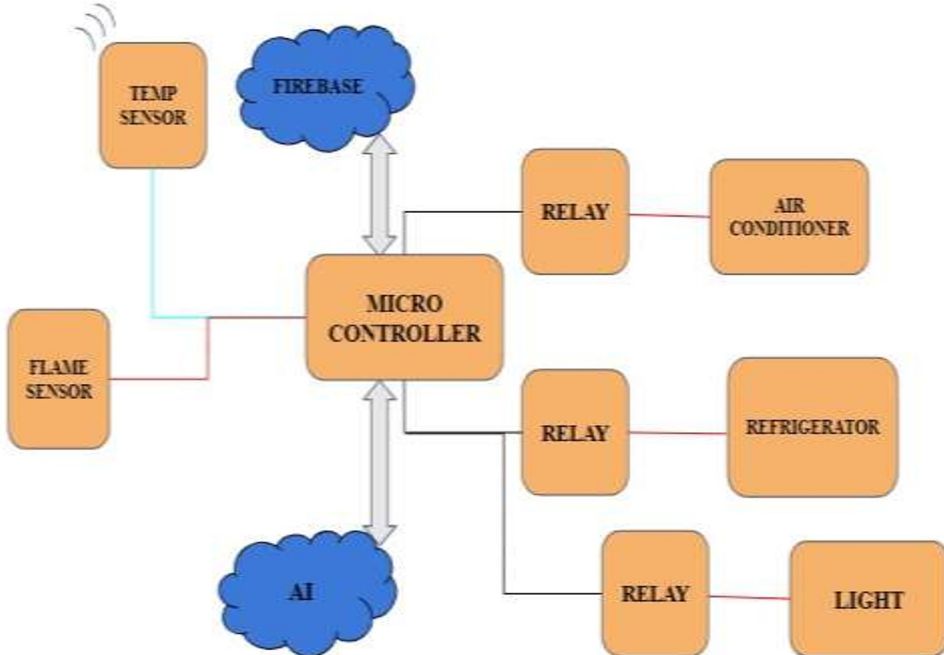

Figure 1: Block Diagram of the Home Automation using AI

The temperature sensor will collect the temperature input within the home. Then the Arduino UNO will start working with the AI Commands. For example, if the Temperature is High then the AI will start interacting with the owner. With the owner's response the Controller will operate the AC or FAN within the home and the appliances will be in the ON mode. Otherwise, the owner will not respond with the AI then it automatically turns ON or OFF with the recent data stored in memory. This working operation will handle Arduino UNO with the commands of Artificial Intelligence.

In the kitchen there is a chance to get flame. With that there is a chance of damaging the property. So that we can keep the Flame sensor that detects the flame values. If any Flame is detected with that sensor, then the AI starts to initialize. Later AI will give Alerts and also send the notification to the owner of the home.

In the home major thing is to switch ON the Lights which is the main task for all owners. That will be going to stop after implementing this project. The LDR sensor will detect the level of light within the home that sensor is interfaced with an Arduino UNO. If the LDR

sensor does not detect any light in the home then the AI will start asking the commands if the owner will react with those commands, then the lights in the home will turn ON. If the sensor detects the light in the home, then again AI starts asking the commands so that we cannot react to those commands then it automatically turns OFF with the past data and that will be stored in the memory.

Nowadays security is a major issue. If any unknown person comes and enters the home without our permission, we can identify with a notification and also give some type of sound like "Hello Welcome to My Home" This will happen after the implementation of this project. The camera module will be placed entrance of the home. At initial implementation, we train the AI and ML with family members data like various facial expressions and finger prints etc. So that the controller will recognize the known and unknown persons those who are going to enter the home. If any unknown person is trying to enter the home, the system will directly say "Sorry You Are Not Family Member So I Don't Give Any Way to Go Inside the Home" and the doors will not open.

4. Workflow

The below diagram shows the overall workflow of Home Automation using AI. First of all the process will start with a given power supply then the system will start initializing (i.e. Artificial Intelligence will initialize)
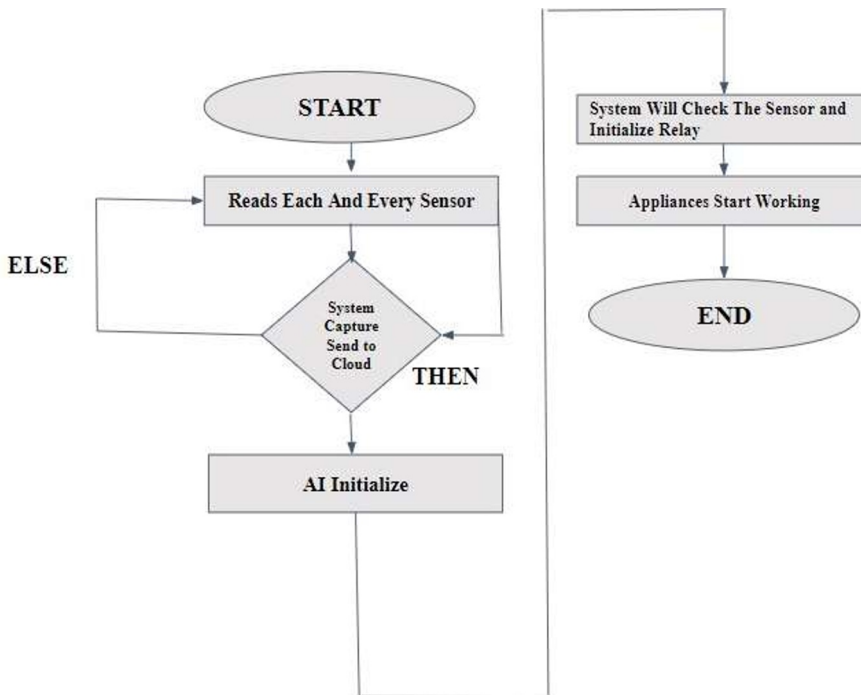

Figure 2: The process flow diagram of Home Automation System.

After the system is initialized, the sensors will start reading the data with respect to sensor specifications. If the system receives the data with the sensors, then it will be sent to the

cloud. Otherwise, again the sensors will start reading the data with these processes will come under the IoT part.
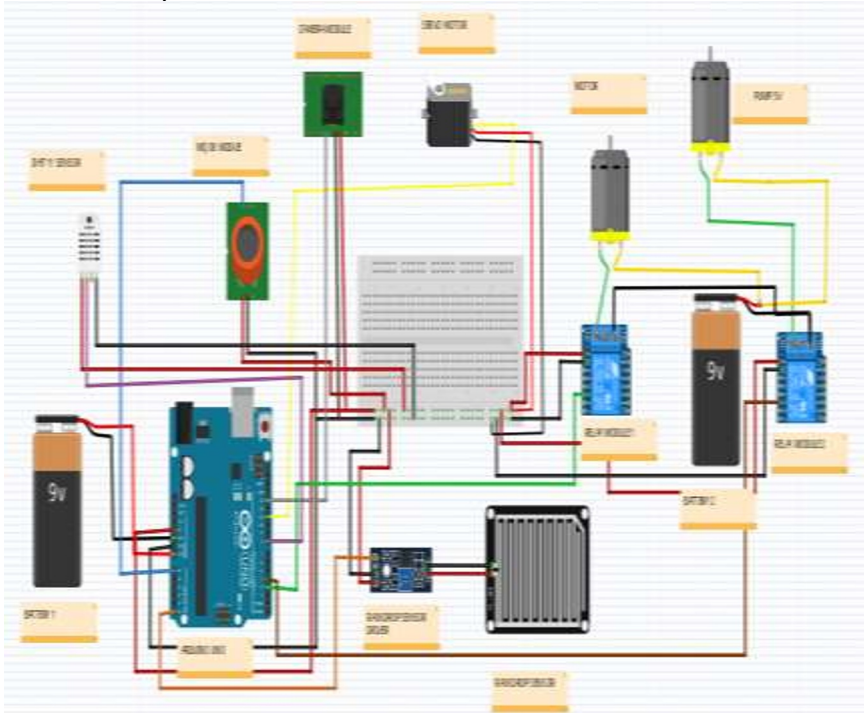

Figure 3: Schematic Diagram of Home Automation Using ARDUINO controller integrated with Sensor's

5. Experimental Results

Home Automation is interfaced with Artificial Intelligence makes advanced Technology in our day-to-day lives. By interconnecting the home appliances with sensors that give efficiency and accurate outcomes. This system can sense and observe daily behaviors and activities, automating appliances, like Lighting Climate control, and Security. In the future AI and home automation promise is one in which our living environments will naturally adapt to our needs, and enhancing our quality of life with never-before-seen levels of comfort and customization.

In this paper we are focusing on the 3 Home Appliances

1. Temperature level
2. Smoke level
3. Water level in Tank

Temperature level:

Figure 4: Graphical representation of Temperature values measured through DHT11 sensor by Home Automation System.

Here, the value of the temperature is medium. Later the values of temperature will be increased are shown in the graph. This graphical representation will be taken from the DHT11 sensor will be connected to the Arduino UNO (controller). The sensor will be connected the Temperature will reach the Threshold value then automatically turns ON the FAN in our home.
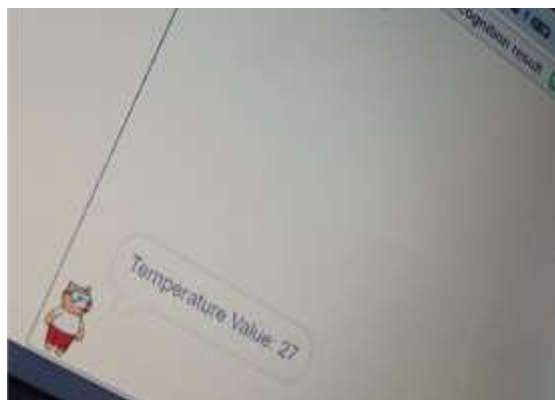

Figure 5: Serial Monitor output of Temperature sensor.

When the Temperature value is 27^0 C and above, then the Controller will automatically turn ON the fan. Else the temperature value is Less than 27° C it turns OFF the fan.

Smoke level:
Smoke level is under 2 levels
  A.   Low Smoke level
  B.   High Smoke level
Low Smoke level:
At this stage the smoke level is normal in home. The below graph is showing normal gas level in home.
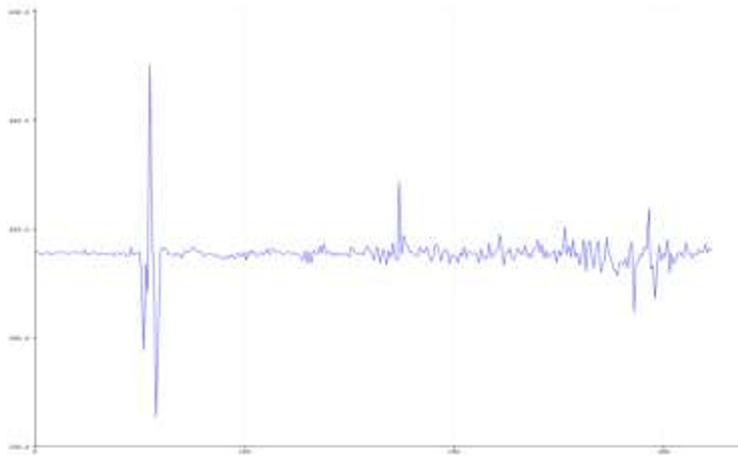
Figure 6: Representation of Normal Smoke level in Home during the system process.

High Smoke level:

When the Smoke is High then the Arduino UNO (Controller) will automatically turns ON the Exhaust fan and also sends the notification in mobile. So that the owner of the home can know the information of the smoke.

Figure 7: Graphical representation of High Smoke level

Figure 8: High Smoke Range in Home

When the smoke value reaches 200 then it gives an alert in homes like a beep sound.The smoke value reaches the threshold value (300) then it Turns ON the exhaust fan and also sends the notification to the owner.

Water level:

From the below figure 9 graph shows the normal water level in the tank. When the water level is Too LOW then it automatically turns ON the water pump.
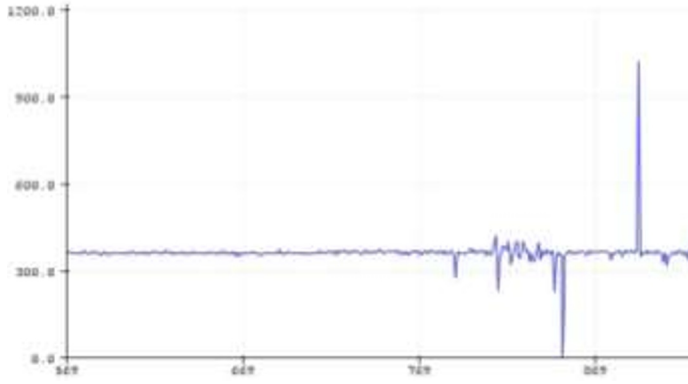

Figure 9: Graphical Representation of water level in Tank
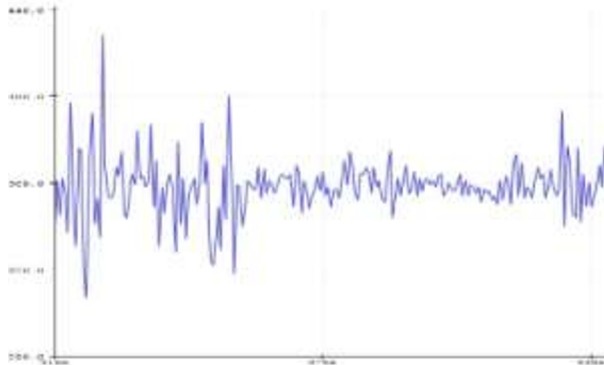

Figure 10: Graphical Representation of water level is High in tank

When a water level sensor is in high state, it shows that the tank is full to its maximum capacity (725) in a tank. Then it automatically turns OFF the water pump

Figure 11: Water tank level indication through serial monitor

AI Recognising the Voice Commands:

Figure 12: Testing of thevoice commandsrecognition through AI.

IoT with Artificial Intelligence technologies enables real-time monitoring of the Temperature, Smoke, and Water levels in our homes. The sensors will collect the data then it is processed with AI algorithms which is user-friendly

Conclusion

Artificial intelligence (AI)-based home automation is the process of incorporating AI technology into the administration and control of different home appliances and systems. Home owners can experience a more effective, practical, and responsive living space by utilizing AI. AI-driven home automation systems monitor, assess, and adjust to the preferences and needs of the occupants via a network of linked devices and sensors. This makes it possible to automate and optimize processes like altering the lights, thermostats, security cameras, appliances, and entertainment systems.Data analysis and collecting are essential to AI-powered home automation. The home is equipped with sensors that collect data on temperature, humidity, occupancy, and energy usage. Then, using the habits and preferences of the occupants, this data are fed into AI algorithms, which identify patterns and come to wise judgments.Natural language commands can be used by consumers to communicate with their smart devices through voice assistants, a popular AI use in home automation. This makes physical interfaces unnecessary and streamlines the control procedure. Integration with services like as Google Assistant, Apple Siri, and Amazon Alexa allows homeowners to do a variety of functions, such as playing music, setting timers, and turning off lights.

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