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Smart Home Automation using IoT and Machine Learning

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Abstract - Due to ever expanding role of machine learning and Internet of Things (IoT) Home automation and its applications to the common world are increasing rapidly. The advancement of the technology has helped build up smart devices which are designed and developed specifically for home use and its automatic connectivity feature and smart use has increased its use even more. There are many devices which are developed for various features such as smart TV, smart fridge, smart business, e-learning etc. In this paper we are going to discuss the development and functionality smart home automation system using IoT and machine learning and how its functionality affects the people and the market.

Keywords: *Machine learning, IoT, smart home automation*
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I.   INTRODUCTION

The Internet of Things is the network of smart devices like phones, computers, vehicles, home appliances, etc. which are embedded with sensors, software, actuators, and connectivity which makes communication possible between the devices. Communication between devices is in the form of exchange of data, or it can also be conversational. This helps in integrating our devices of daily use into the computer-based world so that we may control them through computers. It results in more efficient processes, reduced human intervention and economic benefits. The concept is, devices of a surrounding get the capabilities to communicate with each other, with the Internet and can take decision smartly based on that communication. For any IoT application, it is crucial to protect data, user privacy, and safety. Breaches can harm production continuity and business processes, customers' trust, and – worst of all – human health and life [1]. IoT is already playing a major role in transforming cities beginning with critical infrastructure like energy, transportation, and communication systems and because of its increasing applications and demand in form of reliable and smart devices, it has become important to understand how protecting and building resilience in critical infrastructure is not only crucial to national security, but to society as a whole [4].

 The current research focuses more on the building up a smart home, a home that is able to control and make decisions of its own. Internet of Things contain a huge no of sensors and microcontrollers connected together with a network and transfer of data is done in order to pass out the control to the devices to finally perform a function or a specific task. These sensors produces huge amount of data and is generally managed by the cloud.

II.   IOT APPLICATIONS

1. Startups- Startups can use IoT functions and platforms to equip their products with remote control and real time monitoring functions and ease their business to earn profits.
2. Industrial, agricultural and transportation sectors- These sectors can efficiently use IoT through remote monitoring of devices and vehicles, collecting sensor data for real time monitoring and analytics prove to be highly efficient for profits and customer satisfaction.
3. Hospital and HealthCare- IoT devices and platforms are greatly and efficiently used in healthcare sector for various diagnosis treatments and even surgeries.
4. Smart City, Smart Business and Smart E-Learning- IoT devices are designed and developed wich enables automation and management of connected devices and regulate data over the internet. This makes use of IoT to develop smart city or smart business applications.

III.   POWER OF IOT

As all of the devices begin to store data about our activities, they will begin to understand our lives. Data from all the connected devices from the bigger organization can get collected and analyzed by data analysts and then can apply advanced machine learning algorithms to make smart decisions by those connected things.Like you entered the room and lights, fans get automatically switch on / off depending on the intensity of light and temperature of the room. You don't even have to touch switches. "SMART". Even more, you can check the status of your home devices from anywhere in the world and can control them also via cell phone, web etc.

IV.   HOME SECURITY

The application of artificial intelligence and deep learning in security systems is destined for disruption. If you are using Facebook (which is highly likely) then you must be aware of the feature of tagging photos of your friends, here Facebook

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uses AI for facial recognition and it does the work with 97% accuracy [3]. Similarly, through a facial recognition algorithm, an AI-powered system builds a catalog of known individuals through your social media connections and home visits, which helps it to understand between family members, guests, and visitors. Through this technique, there will be a substantial reduction in false alarms.These self-monitored security systems coupled with motion detectors, sensors, and security cameras will easily assess a potential break-in and even call for emergency services. This eliminates the need for human monitoring [4].

V.   CONCERNS

AI-driven home automation system certainly offers peace of mind to homeowners as it takes care of convenience, home security, and energy efficiency. Thought to achieve a widespread acceptance, the system has to pass obstacles like the initial investment cost of such an intelligent system that comes with multiple devices.And most importantly, these systems should be highly secured as a single attempt of hacking into such a centralized system can lead to invade in privacy and loss of sensitive information [4].

a.   Machine Learning and IoT

Machine learning uses supervised learning techniques on historical data to make cognitive decisions. The greater the quantity of historic data, the better the decision-making capabilities of the algorithm. This philosophy makes IoT the ideal use case for machine learning as the data generated by the devices are usually very frequent [5]. Intelligent systems utilize AI and machine learning to extract more insights from collected data and optimize their interactions within an IoT ecosystem. As basic IoT use cases have been successfully gaining ground, further enhancement offered by AI will galvanize even greater progress. Autonomous vehicles and robots at manufacturing facilities maximize production and delivery speed while unparalleled surveillance capacity provided by AI-supported security cameras radically transforms criminal-justice systems. To allow for these cutting-edge solutions, IoT platforms must be designed to support flexible integration with AI systems and offer scalable, resilient device orchestration.

b. An AI-powered Smart Home?

When it comes to AI-powered smart homes, there are two significant approaches that are customarily considered - the world model, and machine learning. In a world model, the system intelligence is usually applied through programming, whereas the other approach, machine learning, develops a framework that virtually resembles a human thought process, leading to the creation of environments competent enough to learn and update its own world models. Ideally, a smart home would combine a wide variation of sensory interfaces, such as voice and facial recognition, context-

based suggestion, or responsive notifications that decrease the volume of input required on the part of a homeowner. All these would essentially come in concert to develop a spontaneous system, simplifying and streamlining a user's' decision-making processes in a speedily changing ecosystem [6].

VI.   PROPOSED SYSTEM

The proposed system is a simple framework of various applications and device connected together along with a server and the communication is done to perform a specific task related to the specific device for the system. The entire communication of data is handled by the sensors and different types of sensors manage different types of data irrespective of their functionality.
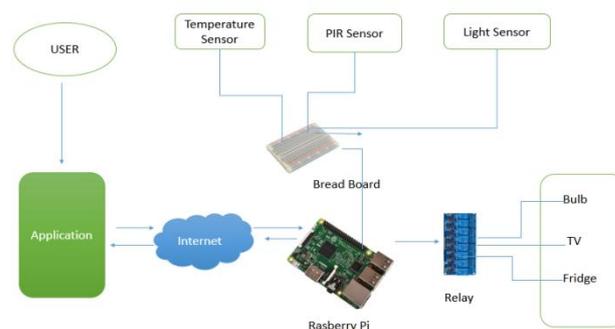

Figure 1. Proposed system for home automation

The basic idea behind this work is to develop an intelligent home automation system smart enough to take control of its activities and take decisions accordingly. Raspberry Pi is a very powerful microcontroller which has a efficiency to connect to devices and data effectively and communicate with eachother. With this framework to be developed a smart and intelligent system is able to manage the activities according to its gadgets and build an intelligent smart home system.

VII.   ADVANTAGES

The inherent benefits of artificial intelligence and machine learning are multidimensional. An AI-based smart home, besides optimizing resources and heightening the productivity of a user, can also add to the safety, proving to be life-saving in extreme scenarios such as a fire outbreak. The AI, sensing a blaze, would promptly alert each member of the house, intelligently escorting them to a secure location using only the routes it thinks are safe for them to use. Adults are notified throughout the process so that they are aware of the fire, position of the occupants, as well as the evacuation activities that are underway.

VIII.   CONCLUSIONS AND FUTURE WORK

With the rise of Internet of Things and more powerful computers, we will be able to achieve Utopian homes using Smart Automation powered by Machine Learning

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Algorithms of higher complexity than Temporal Difference based Reinforcement Learning running on current data. More data will lead to better prediction of potential user action which will help us lead more comfortable lives. Physically challenged people can also benefit from such systems which will eventually make them more independent, as more and more data gets collected to predict such users' habits. The impact of this technology on human lives will be deep and possibly every human-machine interface in the future will have some form of machine learning powered intelligent assistance.

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