A PROJECT REPORT PHASE 1

VOICE-ACTIVATED SMART BLINDS USING MACHINE LEARNING

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By

P VISHNU – SNC18CS025

ABHISHEK N – SNC17CS001

SREEHARI K – SNC18CS032

SALMATH S P – SNC18CS027

ADHITH VINOD – SNC18CS002

ANASWARA RAJAN – LSNC18CS035

Under the Guidance of

Prof. NIMISHA M K

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SREE NARAYANA GURU COLLEGE OF ENGINEERING AND TECHNOLOGY, PAYYANUR

AFFILIATED TO A P J ABDUL KALAM TECHNOLOGICAL UNIVERSITY, KERALA

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SREE NARAYANA GURU COLLEGE OF ENGINEERING AND TECHNOLOGY, PAYYANUR

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CERTIFICATE

This is to certify that the project report entitled **VOICE-ACTIVATED SMART BLINDS USING MACHINE LEARNING** submitted by **SREEHARI K (SNC18CS032)**, in the partial fulfillment for the award of the Degree of Bachelor of Technology in Computer Science and Engineering to **A P J ABDUL KALAM TECHNOLOGICAL UNIVERSITY, KERALA,** is a record of bonafied work carried out under my guidance and supervision.

SEMINAR GUIDE

Prof. NIMISHA M K

Assistant Professor

Dept of Computer Science and Engineering

SNGCET, Payyanur

HEAD OF THE DEPARTMENT

Prof. SUNDER V

Assistant Professor

Dept of Computer Science and Engineering

SNGCET, Payyanur

DECLARATION

I **SREEHARI K** ,hereby declare that the dissertation entitled **VOICE-ACTIVATED SMART BLINDS USING MACHINE LEARNING** , submitted for the B.Tech Degree is our original work and the dissertation has not formed the basis for the award of any degree, associate ship, fellowship or any other similar titles.

SREEHARI K

SNC18CS032 **PAYYANUR**

DATED SIGNATURE **17/06/2022**

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Thanking you

SREEHARI K

INDEX

LIST OF FIGURES

LIST OF SHORT FORMS

AC	Adaptive Controller
IOTF	IOT Framework
IOT	Internet Of Things
SRP	Speech Recognition Platform

ABSTRACT

The emergence of the Internet of Things concept has provided a great vision for the technological future, intending to enable the extraction and comprehension of information from the environment around us, making use of the interaction and cooperation between several technological devices. The example of Smart Homes, in particular, aims to integrate these devices into households, enabling the automation of tasks previously performed by humans, to simplify their daily lives and create a more comfortable environment. However, many of these devices fail to keep their promise, since they were not developed taking into account the frequent change of habits and tastes of the user, being necessary reprogramming of the device to follow the new behaviors. Taking this problem into account, this article presents the design and end-to-end implementation of a voice-activated smart home controller for intelligent devices,deployed in a real environment and validated in an experimental setup of motorized blinds. The architecture of the proposed solution integrates evolvable intelligence with the use of an Online Learning framework, enabling it to automatically adapt to the user's habits and behavioral patterns. The results obtained from the various evaluation tests provide a validation of the operation and usefulness of the developed system.Voice controlled smart blind based on updations of sensor readings.

CHAPTER 1

INTRODUCTION

The emergence of these devices has driven Internet of Things’ vision of intelligentenvironments such as smart buildings and smart homes. Increasingly, consumers are bringing home intelligent devices such as televisions, light bulbs, fans, heating systems, or even blinds. To further simplify the integration of all these devices, smart home hubs have emerged, often integrated with a personal assistant. being now possible to carry out a large number of tasks without much effort, often at a distance of a simple voice control, or even through simple automations that do not require any input from the user. Many of these devices are still based on classical and low intelligence programming.

Developing smart home solutions with devices like these becomes a complex process, with the software having to be customized for every different home and family, and having to be updated as the family’s lifestyle changes. The majority of users do not have the capabilities necessary to address the programming task, and the alternative of hiring professionals to perform such upgrades is quite expensive and inconvenient. As a hypothetical solution to this problem, it is proposed the use of Online Learning techniques, an area of ML, to create a smart home controller capable of adapting to the habits and preferences of the user and capable of evolving with the same. In this work, a smart home controller was used to control motorized home blinds, creating a functional and convenient smart blinds solution.

CHAPTER 2

SYSTEM ANALYSIS

2.1 Existing System

In order to keep up with the latest technological trends, many manufacturers are now launching what are called ‘‘smart devices’’ on the market. The emergence of these devices has driven Internet of Things’ vision of intelligent environments such as smart buildings and smart homes. Increasingly, consumers are bringing home intelligent devices such as televisions, light bulbs, fans, heating systems, or even blinds. To further simplify the integration of all these devices, smart home hubs have emerged, often integrated with a personal assistant, being now possible to carry out a large number of tasks without much effort, often at a distance of a simple voice control (’’Alexa, turn on the lights’’), or even through simple automations that do not require any input from the user.

The development of Artificial Intelligence techniques, such as Machine Learning (ML), has further boosted these ideas . The objective of using these techniques in smart homes is to improve their efficiency and responsiveness to the needs and routines of the inhabitants by anticipating them instead of relying on direct commands or pre-programmed scenarios. Furthermore, ML allows the home to recognize different inhabitants and profile their actions individually to learn their behavioral patterns. This information can be later used to detect anomalous behavior which could be a sign of user health or safety risk, or to make energy consumption more efficient in the house . These paradigms have given rise to several new approaches in the context of intelligent home devices, however, despite their ability to drive the evolution of intelligence in these devices and to enable solutions capable of adapting to the habits and preferences of their users, many manufacturers do not fully accompany this transition. Many of these devices are still based on classical and low intelligence programming. Developing smart home solutions with devices like these becomes a complex process, with the software having to be customized for every different home and family, and having to be updated as the family’s lifestyle changes. The majority of users do not have the capabilities

necessary to address the programming task, and the alternative of hiring professionals to perform such upgrades is quite expensive and inconvenient. The need then arises for a solution that allows devices to observe and adapt to the lifestyle and tastes of the inhabitants of the house in order to learn how to anticipate and accommodate their needs . Taking into account the challenges that arise from the existing ‘‘smart devices’’ described above, it should be clear that a new solution is in need. As so, the following research question is posed.As a hypothetical solution to this problem, it is proposed the use of Online Learning techniques, an area of ML, to create a smart home controller capable of adapting to the habits and preferences of the user and capable of evolving with the same. In this work, a smart home controller was used to control motorized home blinds, creating a functional and convenient smart blinds solution. The remainder of this document is structured as follows: It is presented the related work present in the literature and some challenges and gaps are drawn presents an overview of the implementation process and the methods and tests used to validate functioning of the proposed solution. Next,, the results obtained from the various tests will be presented, as well as a discussion and critical evaluation of the same. Additionally, some limitations of this work are raised in . Finally, Section VI presents the conclusions that were drawn from this work, and some suggestions for future work are presented. The architecture described in this chapter seeks to take advantage of some characteristics of ML, namely, its ability to learn and to distinguish patterns not perceptible to the human being. More specifically, Online Learning techniques were used, in order to obtain an intelligent solution capable of adapting and evolving with the user. The proposed solution also integrates the possibility of voice control, control over a mobile application or through a web interface. All these features must be implemented in a single device (a Single Board Computer) small, light, compact and portable. In order to predict and adapt to the user's behaviors, the controller must be composed of several modules, responsible for different aspects of the system. As can be seen in Figure 1, the proposed architecture for the smart home controller is composed of three main modules, a Speech Recognition Platform (SRP), an IoT Framework (IoTF) and the Adaptive Controller (AC). The SRP is responsible for converting the user's voice commands into machine perceptive intents. The IoTF serves as the middleman between the SRP and the several integrated smart devices, translating the user's intents into actions recognized by the devices for which they are intended. This module also serves to provide a graphical user interface, via a web page or mobile application. The interaction between the user and the controller is restricted to requests made through the SRP or one of the available graphic interfaces. Finally, the AC contains a ML model that is trained on the behavioral patterns of the user to predict the output of the device being controlled. Although security and privacy issues are not the focus of this work, normal functioning without an Internet connection was considered as a requirement for every module, to avoid having the user's voice processed elsewhere other than in the controller and to avoid having to rely on a good Internet connection. As such, all devices are interconnected using a local area network without Internet connection. The smart home controller is capable of controlling most smart devices, however, validation was carried out with the use of developed smart blinds. The blinds are connected to the controller, more specifically to the IoTF and the AC to receive commands and send updates on its status. Both the SRP and the IoTF support other devices, however, the AC only supports the developed smart blinds. This solution integrates four sensors, two brightness and two temperature sensors. Each pair of sensors (one temperature and one brightness) is placed on the interior and exterior portion of the blinds to collect data in real time, both outsideand inside the room where the blinds would be installed. This data will then be used as training features for the ML model.

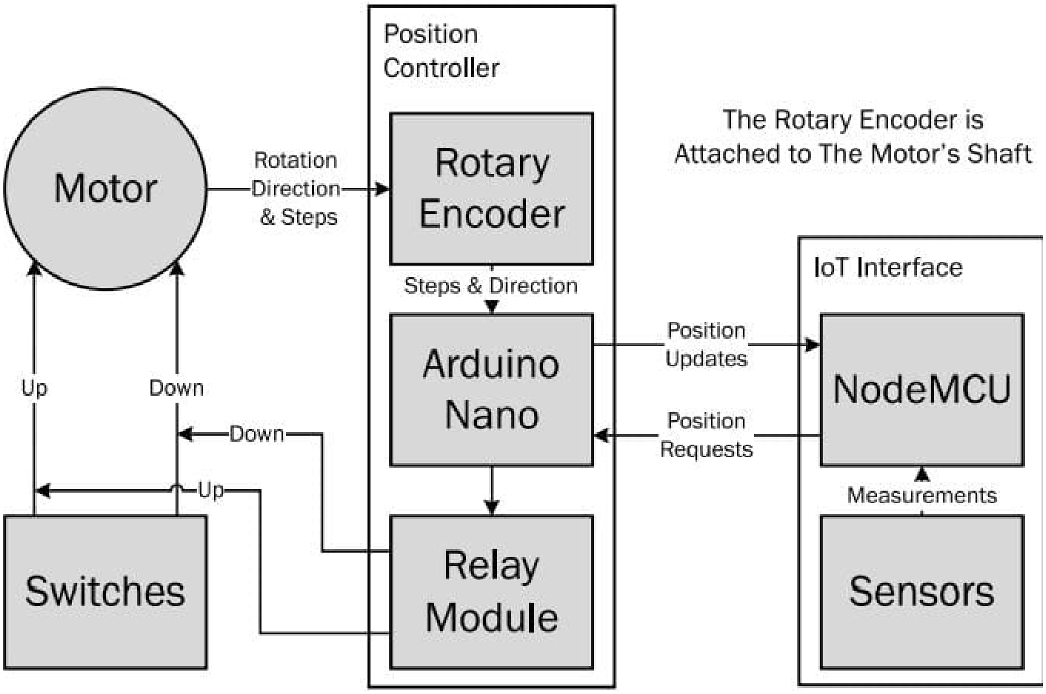

Fig2.1 : Smart blinds' topology

2.2 Literature Review

2.2.1 A. D. Giorgio and L. Pimpinella, ''An event driven smart home controller enabling consumer economic saving and automated demand side management,''

In this paper the SHC planning problem for energy management in the home domain has been faced.The problem has been formulated as an event driven binary linear programming problem, the decision variables representing all the possible start times of smart appliances in a given planning horizon; the contractual power threshold has been replaced by a VPT taking into account the forecast of power consumption from CLs, MLs and DLs, in order to properly introduce an overload constraint related to PLs. A new optimization is performed each time user requests and DMS messages trigger the controller, which then results in an event driven load shifting aiming to meet the real-life dynamics of an household. The proposed formulation allows to take into account relevant scenarios from consumer and retailer point of view: here overload management, optimization of economic saving in case of ToU tariff and DSM have been discussed. Simulation results show that SHC succeeds in optimizing the cost related to the execution of a set of smart appliance programs, while assuring overload management. Starting from the related economic evaluations, the effects of DSM price/volume signals have been simulated and then analyzed by performing proper comparisons. Notification of energy price reduction in a specific temporal slot results in an additional saving, the amount of which decreases as the number of loads involved in the planning increases; on the contrary a request of power threshold reduction results in a missing saving, which has to be given back in order to allow consumer participation to the energy program. In the light of above this work provides a proof of concept about the advantages coming from the use of energy management systems in the home domain, showing the possible benefits for consumers and, indirectly, for other actors of the electric system. It is straightforward to see that the massive application of DSM policies operated on clusters of consumers can result in significant peak power shifting and clipping, which are key functionalities for a cost effective use of power plants, balancing of demand and renewable energy sources and, more in general, an efficient operation of the whole electric network. As a matter of fact a promising direction for future works considers the introduction of MG and other pricing models in the formulation of SHC planning problem, the investigation of DSM strategies acting on a significant number of SHCs and the integration of SHC clusters, DG and storage devices for demand/supply balancing.

2.2.2 H. Oosterhuis and M. de Rijke, ‘‘Balancing speed and quality in online learning to rank for information retrieval,’’

In this paper we have addressed the speed-quality tradeof that has been facing the field of OLTR. Expressive models are capable of learning the most optimal rankings but require more user interactions and as a result frustrate more users during training. To put it bluntly, users may be frustrated in the initial phase of learning; models that converge at the best rankings frustrate the users for the longest period.As a solution we have introduced two methods. The first method is a ranking model that ranks by feature similarities with reference documents (Sim-MGD). Sim-MGD learns faster and consequently provides a much better initial user experience. As predicted by the speed-quality tradeof it converges towards rankings inferior to MGD. The second is a cascading approach, C-MGD, that deals with the speed-quality tradeo, by using a cascade of models. Initially the simplest model in the cascade interacts with the users until convergence is detected; at this point a more expressive model continues the learning process. By doing so the cascade combines the best of both models: fast initial learning speed and optimal convergence.The introduction of C-MGD opens an array of possibilities. A natural extension is to consider expressive models that have been successful in Outline-LTR and place them in C-MGD as the short-term user experience can be addressed by C-MGD. E.g., an OLTR version of LambdaMart could be appended to a cascade that starts with the Sim-MGD model, then switches to MGD and finally switches to a novel OLTR regression forest. Currently,there is no OLTR method of gradient estimation for non-linear structures like regression trees: the introduction of C-MGD removes an important hurdle for research into such methods. Additionally, an initialization method has to be introduced to enable the switch between such models. Ideally, the cascading approach should be extended to predict whether switching model space will have a positive effect;multileaving may be adapted to infer such differences.

2.2.3 A. Al-Fuqaha, M. Guizani, M. Mohammadi, M. Aledhari, and M. Ayyash,‘‘Internet of Things: A survey on enabling technologies, protocols,and applications,’’

The emerging idea of the Internet of Things (IoT) is rapidly finding its path throughout our modern life, aiming to improve the quality of life by connecting many smart devices, technologies, and applications. Overall, the IoT would allow for the automation of everything around us. This paper presented an overview of the premise of this concept, its enabling technologies,protocols, applications, and the recent research addressing different aspects of the IoT. This, in turn, should provide a good foundation for researchers and practitioners who are interested to gain an insight into the IoT technologies and protocols to understand the overall architecture and role of the different components and protocols that constitute the IoT. Further, some of the challenges and issues that pertain to the design and deployment of IoT implementations have been presented. Moreover, the interplay between the IoT, big data analytics, cloud and fog computing has been discussed.We finally presented the need for new “smart” autonomic management, data aggregation, and protocol adaptation services to achieve better horizontal integration among IoT service. Finally, detailed application-use cases were presented to illustrate typical protocol integration scenarios to deliver desired IoT services.

2.2.4 B. Qolomany, A. Al-Fuqaha, A. Gupta, D. Benhaddou, S. Alwajidi, J. Qadir, and A. C. Fong, ‘‘Leveraging machine learning and big data for smart buildings: A comprehensive survey,’’

The promise of smart buildings (SBs) is a world of appliances that anticipate your needs and do exactly what you want them to at the touch of a button. Since SBs and their inhabitants create voluminous amounts of streaming data, SB researchers are looking towards techniques from ML and big data analytics for managing, processing, and gaining insights from this big data. This paper reviewed the most important aspects of SBs with particular focus on what is being done and what are the issues that require further research in ML and data analytics domains. In this regards, we have presented a comprehensive survey of the research works that relate to the use of ML and big data particularly for building smart infrastructure and services. Although the recent advancements in technologies that make the concept of SBs feasible, there are still a variety of challenges that limit large-scale real-world systems in SBs field. Addressing these challenges soon will be a powerful driving force for advancements in both industrial and academic fields of SB research.

2.3 Proposed System

The proposed solution also integrates the possibility of voice control, The proposed architecture described in this chapter seeks to take advantage of some characteristics of ML, namely, its ability to learn and to distinguish patterns not perceptible to the human being. More specifically, Online Learning techniques were used, in order to obtain an intelligent solution capable of adapting and evolving with the user. The proposed solution also integrates the possibility of voice control over a mobile application or through a web interface. All these features must be implemented in a single device (a Single Board Computer) small, light, compact and portable.In order to predict and adapt to the user’s behaviors, the controller must be composed of several modules, responsible for different aspects of the system. As can be seen in Figure 1, the proposed architecture for the smart home controller is composed of three main modules, a Speech Recognition Platform (SRP), an IoT Framework (IoTF) and the Adaptive Controller (AC). The SRP is responsible for converting the user’s voice commands into machine perceptive intents. The IoTF serves as the middleman between the SRP and the several integrated smart devices, translating the user’s intents into actions recognized by the devices for which they are intended. This module also serves to provide a graphical user interface, via a web page or mobile application. The interaction between the user and the controller is restricted to requests made through the SRP or one of the available graphic interfaces. Finally, the AC contains a ML model that is trained on the behavioral patterns of the user to predict the output of the device being controlled. Although security and privacy issues are not the focus of this work, normal functioning without an Internet connection was considered as a requirement for every module, to avoid having the user’s voice processed elsewhere other than in the controller and to avoid having to rely on a good Internet connection. As such, all devices are interconnected using a local area network without Internet connection.The smart home controller is capable of controlling most smart devices, however, validation was carried out with the use of developed smart blinds.

The blinds are connected to the controller, more specifically to the IoTF and the AC to receive commands and send updates on its status. Both the SRP and the IoTF support other devices, however, the AC only supports the developed smart blinds. This solution integrates four sensors, two brightness and two temperature sensors. Each pair of sensors (one temperature and one brightness) is placed on the interior and exterior portion of the blinds to collect data in real time, both outside and inside the room where the blinds would be installed. This data will then be used as training features for the ML model.Smart shades and blinds that extend, retract, or tilt automatically are indeed a luxury, but they're also just plain useful. (And they can help save energy and boost home security, too.) Lutron's Serena Shades are our top pick because they work flawlessly, are the fastest and quietest shades we tested, and are compatible with all the popular smart-home platforms. Also, they look great. If you prefer blinds over shades, we think Lutron's Serena Smart Wood Blinds are the best smart blinds because they adapt to the position of the sun throughout the day, ensuring you always have the right amount of light without having to adjust them at all.

CHAPTER 3
SYSTEM SPECIFICATION

3.1 SoftwareSpecification

- Java interface : nodejs
- Launguage for machine learning : python
- Code editor : Visual studio code
- Database : Firebase

3.2 Hardware Specification

- Arduino (atmega 328 me)
- Esp-32
- Servo motor
- Mini stepper motor (with driver)
- MIC
- Temp + humidity sensor (DHT11)
- LED (5mm)
- Connecting cables

CHAPTER 4
SOFTWARE DESCRIPTION

4.1 Java interface : nodejs

Node.js is an open-source, cross-platform, back-end JavaScript runtime environment that runs on the V8 engine and executes JavaScript code outside a web browser. Node.js lets developers use JavaScript to write command line tools and for server-side scripting—running scripts server-side to produce dynamic web page content before the page is sent to the user's web browser. Consequently, Node.js represents a "JavaScript everywhere" paradigm, unifying web-application development around a single programming language, rather than different languages for server-side and client-side scripts. Node.js has an event-driven architecture capable of asynchronous I/O. These design choices aim to optimize throughput and scalability in web applications with many input/output operations, as well as for real -time Web applications (e.g., real-time communication programs and browser games).

4.2 Launguage for machine learning : python

Python is a programming language that supports the creation of a wide range applications.Developers regard it as a great choice for Artificial Intelligence (AI),Machine Learning, and Deep Learning projects.The python languagecomes with many libraries and frameworks that make coding easy.This also saves a significant a mount of time.The most popular libraries are NumPy,which is used for scientific calculations; SciPy for more advanced computations;and scikit, for learning data mining and data analysis.These libraries work alongside powerful frameworks like TensorFlow, CNTK, and Apache Spark.These libraries and frameworks are essential when it comes to machine and deep learning projects.

4.3 Code editor : Visual studio code insider

Visual Studio Code, also commonly referred to as VS Code, is a source-code editor made by Microsoft for Windows, Linux and mac OS. Features include support for debugging, syntax highlighting, intelligent code completionsnippets, code refactoring, and embedded Git. Users can change the theme, keyboard shortcuts, preferences, and install extensions that add additional functionality. Visual Studio Code is a source-code editor that can be used with a variety of programming languages, including Java, JavaScript, Go, Node.js, Python, C++ and Fortran.

4.4 Database : Firebase

The Firebase Realtime Database is a cloud-hosted NoSQL database that lets you store and sync data between your users in realtime. Realtime syncing makes it easy for your users to access their data from any device: web or mobile, and it helps your users collaborate with one another. The Realtime Database integrates with Firebase Authentication to provide simple and intuitive authentication for developers. Firebase helps you develop high-quality apps, grow your user base, and earn more money. Each feature works independently, and they work even better together.

CHAPTER 5
HARDWARE DESCRIPTION

5.1 Arduino (atmega 328 me) :

The ATmega328P is a high-performance picoPower 8-bit AVR RISC-based microcontroller having 32KB ISP flash memory with read-while-write capabilities created by Atmel from the megaAVR family. I have mentioned all the Atmega328 pinout details with related Arduino functions.

5.2 Esp-32 :

First launched in September 2016 by Espressif Systems, ESP32 is a dual-core (two microprocessors), dual-mode MCU with both Wi-Fi and Bluetooth built in. The design is a mini-revolution in the IoT space and has spawned clones from every major board maker.

5.3 Servo motor :

The controller is the most important part of the Servo Motor designed and used specifically for this purpose. The servo motor is a closed-loop mechanism that incorporates positional feedback in order to control the rotational or linear speed and position.

5.4 Mini stepper motor (with driver) :

Stepper Motor Drive. A stepper motor drive is a circuit which is used to drive or run a stepper motor. It is often called a stepper motor driver. A stepper motor drive usually consists of a controller, a driver and the connections to the motor. A lot of drive circuits are available in the market today.

5.5 MIC :

The primary mandate of MIC is to encourage, inspire and nurture young students by supporting them to work with new ideas and transform them into prototypes while they are informative years. MIC has envisioned encouraging creation of Institution’s Innovation Council (IICs)’ across selected HEIs.

5.5 Temp + humidity sensor (DHT11) :

DHT11 & DHT22 temperature & humidity sensor are well known models which are used for monitoring the humidity and temperature of a vicinity or place. DHT11 and DHT22 models are used in thermostats and hygro thermometers which are used for different purposes on industrial and domestic levels.

5.6 LED (5mm) :

IR LED 5mm Infrared Transmitter Light Emitting Diode Description Reviews (0) IR LED emits light in infrared region, which is invisible to human eyes. It is a high-intensity diode packed in water clear plastic package.

5.7 Connecting cables :

When it comes to technology, there are different ways to establish physical connection with different devices. This article discusses the types of cables and connectors that are commonly used. In information science, connectors, normally called input-output connectors (or I/O for short), are interfaces for linking devices by using cables.

CHAPTER 6
PROJECT DESCRIPTION

6.1 Module Description

6.1.1 Speech recognition platform

The smart home controller must work without an Internet connection . Communication protocols and Websockets, with built-in support for HA . The Rhasspy allows configurig, programming, and testing the voice assistant . Speech to Text Text to Speech . And Wake Word detection . Transforming audio data into JavaScript Object Notation (JSON) events .The Various algorithms and computation techniques are used to recognize speech into text and improve the accuracy of transcription.

6.1.1.2 Voice Biometrics

This is a rapidly evolving field, also largely driven by AI, which can now be used to enable workflows and collaboration. Biometrics takes many forms other modes, such as retina scans or fingerprinting, have been in use for years but voice has some distinct benefits that align well with a touchless workplace.

6.1.1.3 Speech to text

Like biometrics, this is an application, but among speech recognition use cases, it has great value for collaboration when used with any voice-enabled endpoint that has a keypad. Speech to text (STT) is one of many AI use cases that have become good enough now for everyday use in the workplace, and it's an ideal application for office- or home-based work.

6.1.2 IOT framework:

For the IOT framework HA platform was used . Ability to track control and automate Smart device . HA's Lovelace dashboard can used . 'area' and 'position' are sent from Rhaspy as Slots in the JSON event . Smart blinds are installed and the position they're required to change to. To change the default dashboard, create a new file ui-lovelace.yaml in your configuration directory and add the following section to your configuration.yaml and restart Home Assistant.Multiple DashboardsYou can define multiple dashboards in Home Assistant. Each dashboard can be added to the sidebar. This makes it possible to create separate control dashboards for each individual part of your house. You can manage your dashboards via the user interface. Go to Configuration -> Dashboards. Here you can see all defined dashboards and create new ones. Using YAML for the default dashboard. To change the default dashboard, create a new file ui-lovelace.yaml in your configuration directory and add the following section to your configuration.yaml and restart Home Assistant: lovelace: mode: yaml

YAML is a good way to start this file is to copy and paste the "Raw configuration" from the UI so your manual configuration starts the same as your existing UI.Click Overview in your sidebar. Click the three dots menu (top-right) and click on Edit Dashboard. Click the three dots menu again and click on Raw configuration editor. There you see the configuration for your current dashboard. Copy that into the <config>/ui-lovelace.yaml file. Once you take control of your UI via YAML, the Home Assistant interface for modifying it won't be available anymore and new entities will not automatically be added to your UI.When you make changes to ui-lovelace.yaml, you don't have to restart Home Assistant or refresh the page. Just hit the refresh button in the menu at the top of the UI. To revert back to using the UI to edit your dashboard, remove the lovelace section from your configuration.yaml and copy the contents of your ui-lovelace.yaml into the raw configuration section of Home Assistant and restart.

6.1.3 Smart blinds:

Position controller and IOT interface . Universal Asynchronous Receiver - Transmitter (UART) . Aduino Nano ,a rotary encoder and a three-relay module,The IOT interface is composed of a Node MCU and four sensors . ESPH home platform was used to program the node MCU .This research aims to implement an IoT stick that will view the image of opportunity, autonomy, and certainty. The proposed smart stick is planned with an impediment identification module, a global positioning system (GPS), pit and flight of stairs detection, water detection, and a global system for mobile communication (GSM) to perform their daily activities quickly. The impediment identification module utilizes an ultrasonic sensor alongside a water level sensor to distinguish the obstructions that insinuate recognizing the obstacles and identifying the obstructions pattern. An Arduino ATmega328 is used to advise the weakened people about the barriers and sends notifications using an earphone and a buzzer. The current location of the blind person is located using GPS and GSM modules. The stick activates an alert system in case of loss. Several test cases prove that the functionalities introduced with the stick are performing correctly. Such a stick will be a blessing for blind people having a positive impact on science and technology.

6.1.4 Adaptive controller:

For interpreting the behavioural patterns . Implemented and different ML model is also created . Undergo training period without sending predictions to the user . Pediction refer to the position the blind will be in next timestamp . Recognise of one set of smart blind fail to communicate.When designing adaptive control systems, special consideration is necessary of convergence and robustness issues. Lyapunov stability is typically used to derive control adaptation laws and show .Self-tuning of subsequently fixed linear controllers during the implementation phase for one operating point;Self-tuning of subsequently fixed robust controllers during the implementation phase for whole range of operating points; Self-tuning of fixed controllers on request if the process behaviour changes due to ageing, drift, wear, etc.; Adaptive control of linear controllers for nonlinear or time-varying processes; Adaptive control or self-tuning control of nonlinear controllers for nonlinear processes; Adaptive control or self-tuning control of multivariable controllers for multivariable processes (MIMO systems); Usually these methods adapt the controllers to both the process statics and dynamics. In special cases the adaptation can be limited to the static behavior alone, leading to adaptive control based on characteristic curves for the steady-states or to extremum value control, optimizing the steady state. Hence, there are several ways to apply adaptive control algorithms.A particularly successful application of adaptive control has been adaptive flight control.[7][8] This body of work has focused on guaranteeing stability of a model reference adaptive control scheme using Lyapunov arguments. Several successful flight-test demonstrations have been conducted, including fault tolerant adaptive control

6.2 System Flow Diagram

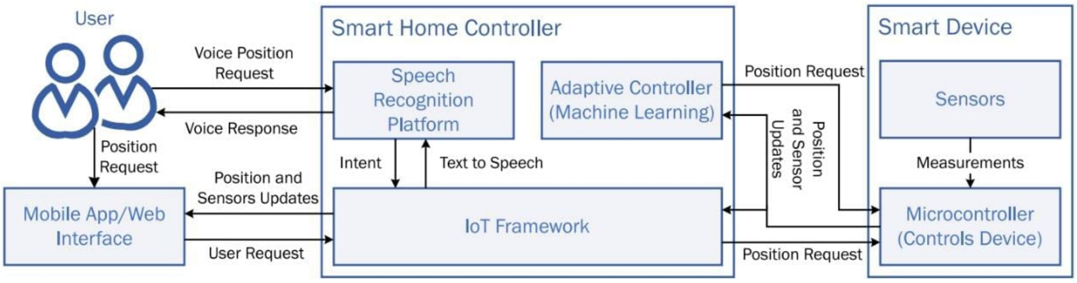

Fig5.2: Smart blinds architecture overview

CHAPTER 6

IMPLEMENTATION PLAN

Storing temperature, humidity, smoke sensor readings into the firebase as database used here accessing the homies. Readings will be credit on the web interface with android application , based on the sensor readings apply conditions to results the prediction of fire or not.If it is fire chance do a precaution or presafety consist on people can control the smart blinds over voice.

CHAPTER 7
CONCLUSION

The emergence of these devices has driven Internet of Things' vision of intelligent environments such as smart buildings and smart homes [1]. Increasingly, consumers are bringing home intelligent devices such as televisions, light bulbs, fans, heating systems, or even blinds. To further simplify the integration of all these devices, smart home hubs have emerged, often integrated with a personal assistant.being now possible to carry out a large number of tasks without much effort, often at a distance of a simple voice control , or even through simple automations that do not require any input from the user. Many of these devices are still based on classical and low intelligence programming. Developing smart home solutions with devices like these becomes a complex process, with the software having to be customized for every different home and family, and having to be updated as the family's lifestyle changes.

The majority of users do not have the capabilities necessary to address the programming task, and the alternative of hiring professionals to perform such upgrades is quite expensive and inconvenient. As a hypothetical solution to this problem, it is proposed the use of Online Learning techniques, an area of ML, to create a smart home controller capable of adapting to the habits and preferences of the user and capable of evolving with the same. In this work, a smart home controller was used to control motorized home blinds, creating a functional and convenient smart blinds solution.

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