Home Automation System with Smart Analytics

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Abstract:
Home Automation Systems are a growing trend in today’s ever changing world. From the smallest of tasks to the more complex ones, everything is slowly being automated these days. These smart homes are becoming a thing for the future to behold. They can be used for simple or elaborate tasks by integrating devices and gadgets inside and outside of your home. A simple definition is the ability to switching the lights on or off to more complex tasks such as being able to tell the user their monthly power consumption. And all of this achievable at the palm of your hands. There are plenty of home automation systems in the world today and the way to develop these home automation systems are numerous. From the internet of things, to the use of GSM and Zigbee modulation. Moreover in this research work the survey of these different home automation systems is discussed and their advantages and disadvantages have also been covered. Adding to that the future implementations of the home automation system industry and which way it would go is also discussed here.

Keywords: Home Automation System, Progressive Web Application, Decision Trees.

I. INTRODUCTION

The main idea behind a automation system includes reducing human effort, make more efficient use of energy, keep a check on power consumption and to help the old aged and the physically impaired people. Couple these home automation systems with a supervised learning algorithm and it brings a completely different perspective to the whole smart home definition. To be able to check out the data and for the algorithm to analyze it and make the entire system even more efficient is a step in the right direction towards an automated world, a world which is inevitable. There are tons of home automation systems in the world today, some far within the reach of the less fortunate, then there are those home automation systems that just aren’t up to standard. The Home automation system with smart analytics isn’t just another home automation system, it’s much more than that, being able to check the power consumption, keeping leader-boards for the devices switched on the most to having sharing capabilities. Data plays a crucial part in smart home systems. Industries and companies that are possession of statistical data have an advantage over the ones that aren’t. Therefore various mechanisms for data collection have been developed and deployed. To be able to exploit this data is the dream of anyone in the Information Technology world, but for the right reasons. The Home Automation System has one of the biggest potential in the Healthcare domain, being able to follow a person’s routine, fluctuations in that very same routine can tell you a lot about a person behavior. Studies have been made to show those changes. According to behavior change detection (BCD), it essentially detects the activity timing and duration changes between windows of time, determines the significance of the detected changes and analyzes the nature of these changes. Energy plays an important role in our lives, and we as people do not realize the amount of energy that we waste each and every day.

II. SMART ANALYTICS

A. What is Smart Analytics?

The Smart Analytics part of this project encompasses Decision Trees. Decision trees are a type of supervised learning algorithm which usually fly under the radar a lot. It is one of the most simplest machine learning algorithms out there. When you talk about Supervised learning algorithms it is about explaining the input and what corresponding output is in the training data according to this the data is continuously split according to a certain parameter. The tree can be explained by two entities, namely decision nodes and leaves, the leaves are the decision and the final outcome. Decision trees learn from data to approximate a sine curve with a set of if-then-else decision rules. The deeper the tree, the more complex the decision rules and the fitter the model.

B. Existing Home Automation Systems

The existing home automation systems in the market right now haven’t exploited the learning curve that decision trees have to offer. Home Automation systems are just meant for toggling off your switches, at least that’s how the people interpret it to be. The problems of just sticking to the traditional home automation system is that you have to settle for just toggling switches and for a steep price.

C. Proposed Home Automation System.

The Home Automation system with smart Analytics will provide that much more for the very same price that traditional home automation systems are doing it for. Making use of decision trees is crucial to the functioning of home automation system. The internal of the decision tree algorithm works based on the ID3 algorithm i.e. the Iterative Dichotomiser 3. To go along with
this we have entropy and information gain, entropy in simple terms means the randomness in attribute for classification task, and information gain is nothing ranking the attribute. To be able to analyze the tons of power consumption data is of the needs of the highest order. One of the most major tasks is showing users their power consumption trends, where about that energy has been wasted, what would be the most efficient way to save this energy, and decision trees would be the most efficient way to go about all this.

III. IOT

Another major question to be asked is why IoT, when there are several methods to develop a home automation system. There’s GSM, there’s Zigbee Modulation, so what makes IoT one of the best grossing and in-demand topics. Most of the automated systems in the world right now include. Each method has its own merits and demerits, but no matter what the development method may be at the end a smartphone or anyone electronic device with a large enough screen is a must.

<table>
<thead>
<tr>
<th>Technology</th>
<th>Feature</th>
<th>Disadvantage</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSM</td>
<td>Access home appliances and control home security by sending and receiving commands in form of SMS. MQ2 and MQ7 sensors used to sense gas leakage.</td>
<td>Delays in sending commands in case of weak mobile network.</td>
</tr>
<tr>
<td>Bluetooth</td>
<td>For Bluetooth technology android based GUI is developed to help owner to communicate with his smart home.</td>
<td>Bluetooth have a range limitation of 100 meter so cannot access system outside range.</td>
</tr>
<tr>
<td>IOT</td>
<td>Sensors and IOT enabled devices used to satisfy the smart home conditions.</td>
<td>In case of sensor failure whole system will collapse because lots of dependency on sensors.</td>
</tr>
<tr>
<td>PIC</td>
<td>Voice based commands are accepted. Relays are used to control home appliances and microcontroller is central processing unit.</td>
<td>Low end controller. No inbuilt communication module.</td>
</tr>
</tbody>
</table>

Table.1. Comparative study [1]

Based on the above mentioned concluded results of the various development technologies, the decision to go with an IoT based system wasn’t difficult.

IV. FUTURE IMPLEMENTATIONS.

In a way the current home automation systems offer very limited exploitation of usage statistics by maintaining a local database. But by implementing two different types of cloud platforms. You would have your traditional home automation data collection mechanism and then you would have the Kaa IOT platform as middleware. This platform provides one with a highly reliable server and customizable server, which can run within a cluster. The server handles all the communication with the database and provides interface towards Cassandra, Mongo DB and Postgre SQL (the one which our home automation system makes use of). To perform simple data retrieval and monitor logs from the desired timeframe, Zeppelin could be used. To enable communication with the Kaa server it is necessary to implement the data collection modules within every endpoint.

V. FEATURES OF HOME AUTOMATION SYSTEM WITH SMART ANALYTICS

A. Convenience

We already live in a world where convenient things play the biggest role. And this home automation system does that. Forgot to switch off the bulb? Nothing to worry about, smart timers associated with the bulb will do the work for you.

B. Reduction of Human Efforts

The elderly and the physically disabled have it very difficult. To work on the simplest of tasks as well it can be quite tedious, this is where home automation systems make things much more easier for them.

C. Energy Savings.

This is not meant only for the aged and the physically handicapped but for all age groups. The smart analytics feature of the home automation system will show the user the power consumption that has been recorded over the past month or week. It will send the user a push notification as to better improve his energy consumption and how he can do so. Leaderboards function will be implemented to show the user the devices that have been used the most.

VI. CONCLUSION

The Project titled “Home Automation System using Smart Analytics” is being developed using Microsoft Visual Studio, Raspberry Pi and languages such as Javascript, HTML and CSS. It is a progressive web application which means that it can serve two purposes, as a native application and as a web application. Smart Analytics will offer users an insight into their power consumption statistics and advise them on how to make better and efficient use of power.

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VII. REFERENCES

