Smart Mosque

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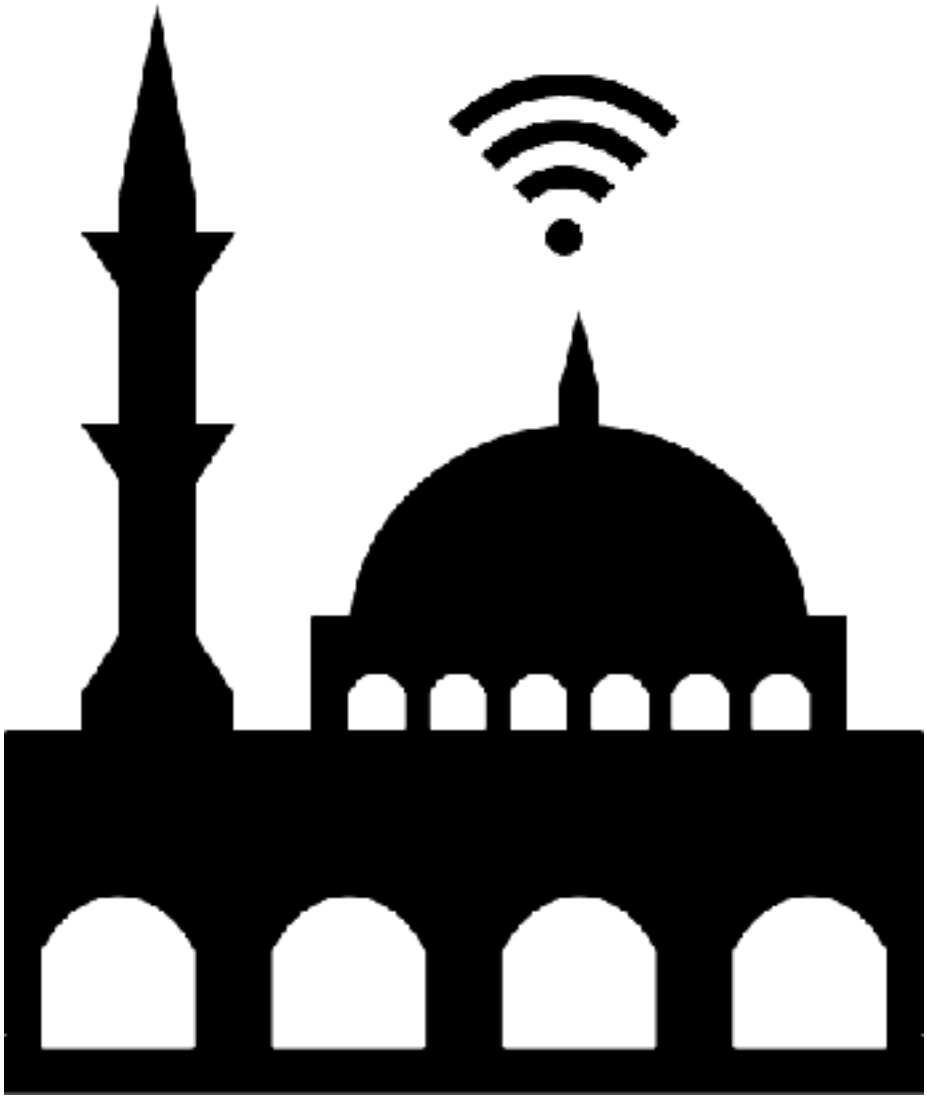

Abstract

A mosque is basically a place of worship of muslims where they visit and gather at least 5 times a day to offer prayer. Since a Mosque is generally a building or a part of the building, hence it needs to be maintained on a daily basis similar to any other building and it incurs cost to meet some of the following basic requirements given below:

- Provide enough water supply for performing ablution (or wudhu, a process of washing hands, feet and face for cleaning and purification each time before prayers).
- Powered by electricity for lights, fans and Air conditioners
- Space to be utilised effectively for maximum accommodation of worshippers
- Azaan or call for prayer 5 times a day

So the proposed solution is an attempt to minimise the cost. This article is just a proposed solution at a higher level and detailed implementation is out of scope of this article.

Problems and challenges faced

So let us look at some of the problems and challenges generally faced in most of the mosques which are listed below :

- Wastage of water during ablution (wudhu) and hence shortage of water faced
- Electricity consumption in excess if not taken care of
- If the mosque has multiple floors then effective utilisation of space is an issue as some floor may be sparsely occupied while some may be overcrowded. Though this is manually managed, but there is a need for improvement on this.
- Most of the times the mosques becomes overcrowded specially during Friday prayers and there is an overflow to such an extent that the visitors have to move out on the surrounding footpath, lanes or roads of the mosque for prayer, which may block way for the people or vehicle using those lanes or roads outside the mosque.
- The prayer timing keeps varying slightly with different times of the year and hence it requires manual updation on a regular basis.

Proposed Solutions

Since a mosque is generally a building or part of a building, hence the solution of a smart building can be implemented for resolving some of the problems faced while some suggested measure can be taken to resolve the other issues as listed below :

Minimising water consumption:

- Usage of an automatic tap water flow using a Infra Red sensors where water only flows when user is in the proximity of the tap to perform ablution (wudhu). Using this sensor the tap water only flows when user bring their hand near the tap and the flow stops when the hand is removed. This way it would save unnecessary flow of water from the tap overall saving significant amount of water.

Minimising electricity consumption:

- Usage of low power consuming lights and fan and in addition using a motion sensor to detect if it is occupied by any person, then the lights, fans and Air conditioner would switch on else it would automatically switch off if it detects no motion for certain period of time, hence saving electricity in case if user forgot to switch off these appliances before moving away from that area.

- Automatic regulator of temperature for Air Conditioner, by using people counter placed near entry and exit points of the rooms or hall where Air Conditioners are installed. So depending on the count of people present it would maintain the temperature suitable for that many number of persons based on some calculations, hence saving electricity and maintaining comfortable environment condition of the room.

Effective space utilisation and preventing crowd overflow:

- For resolving the issue of different floor of a multiple floor mosque getting filled up in an uneven manner, a people counter sensor can be placed on each floor entry and exit points and the current total occupancies of each floor be compared against the pre-calculated floor capacities of each floor and these could be displayed on some display board with the help of some software program developed for this purpose. This would be a real time indicator as which floor is partially vacant and which floor is overcrowded and some people can shift from overcrowded floor to partially vacant floor.

- For resolving the issue of crowd overflow blocking lanes and pavements surrounding the mosque, there can be multiple slots of Friday prayer at interval of 20 to 30 minutes within the time range of the Friday prayer timing. There can also be an application to record the data from the people counter sensor to calculate how much of the mosque is occupied and also a mobile app from which a user can update information as what slot they intend to attend. This would also provide an estimate of how much occupancy is expected in a given slot, depending on which a user can switch to different slot of prayer to avoid overflow if required.

Automated and scheduled water motor pump and Azaan (Call for prayer):

- There can also be an implementation for scheduling the water motor pump to start operating at specific times to fill the main water tank, without the need of manually switching it on and off. There can be also a water overflow sensor that would help provide signal to stop the water motor pump once the water tank is full and overflow occurs.

- The water motor pump can also have the mechanism of switching on when the water level is lower than a certain level, using sensor to detect water level in the water tank, so that water can be filled on demand.

- Though this has never been a trend in any mosque that Azaan (call for prayer) has been given through a recorded audio as it is given out by a person, but if required there could be an automatic Azaan scheduled at the given prayer timings. Also the prayer time would be auto calculated depending on the co-ordinate of the mosque and displayed on the display board.

Conclusion

All the above mentioned solutions for the existing problem would require partial IoT (Internet of Things) implementation for a Smart Building. This would incur cost for the different types of sensors and smart devices (detailed explanations and total cost calculation not in the scope of this article). There is also a need of a persistent internet connection and over the same wifi connection for the IoT sensors and devices to communicate with each other.
This implementation does incur an additional cost but over the time would save a good amount of cost in the long run.

Scope for further enhancements

This Smart mosque implementation can be further enhanced by connecting different mosques and exchanging informations. The informations can be stored as historical data and predictive analysis can be done using AI and Machine Learning providing insights and scope for improvements and enhancements that could further impact the cost and quality.