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Smart Automation System for Office Environment

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Abstract- A smart automation system for office environment is being designed in this system. Various controlling systems based on lighting, ventilating, luminance are discussed respectively. Various sensors are used to extract the real time information i.e. temperature, light intensity, humidity, smoke, motion sensor are used. This data is send to ARM 11 Controller. It is then send to PC where data is saved. Through Network switch this data is send to other PC's. The data collected is stored as database and can be accessed anytime. The data is send to the android or any internet enabled device. This system also provides need based emergency services like Ambulance call, fire alarm. Biometric fingerprint is used for security purpose. Manual mode and automatic mode are two alternative modes designed to promote the usability of smart office system. Control of electric lighting fixtures of different office spaces is done.

Keywords- — automation system; smart office system; alternative modes.

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I.INTRODUCTION

People spend lot of time in offices. Office environment directly affects the working efficiency of employees. So comfort is needed in office. Two decades ago, technology at its best meant a fax machine and an electronic typewriter; today it's an iPad connected to an enterprise cloud solution. A smart office - a place that makes life easy for employees and customers, empowers and it increases their ability to stay connected through by making use of various advanced technology and different tools and solutions to improve the efficiency of users. As the physical boundaries are being bridged, a complex and competitive world focuses on innovation and creativity is being developed. The world is fastly experiencing the emergence of intelligent growth zones so smart office- has fast become the need of the hour. A smart office is one that ensures the optimal and effective utilization of physical infrastructure and IT resources. In other words, offices in today's generation of information technology are automated. There is need for technological advancement environment which is very transparent. Thus the office automation allows the systems to become more transparent, it enables information sharing more openly, which creates an opportunity for making an informed decision which has an great impact across the functioning of the business.

The effective advanced automation, use of various communication tools in the system shows the positive impact on the business and growth of company or any organization over a period of time. Advantage of smart office is the elimination of internal reporting processes, i.e. in/out timings of the employees by an open office arrangement. It also increases the productivity through enhanced communication among team members which affects in the output. A smart office is to be designed with one thing in mind to release full potential of workforce. It's not rocket science just innovative thinking and new technology that best fits people's needs. Office automation among other things facilitates easy documentation and real time communication. The effective automation or use of communication tools in the output of an organisation that showcases the positive impact on the bottom line over a period of time.

The building sector consumes lot of energy. It is one of the main cause of the global energy consumption. Smart building is like a smart home, which is an intelligent space that optimizes efficiency, safety, comfort and by collecting and analyzing sensor data. Modern buildings contain complex mechanical devices, sophisticated control systems and various features to improve the safety, productivity of occupants and safety. A smart building can be considered a super system of interconnected building subsystems. The smart building will require connectivity between all the equipment and systems in a building. It helps building managers to visualize information and make fast and precise decisions. Through a building automation or building management system (BAS), the automatic centralized control of a building's different sub-systems i.e. lighting ,heating, ventilation and air conditioning, and other systems are achieved. Improved efficient operation of building systems, occupant comfort, and decrease in energy consumption and operating costs, and improve life cycle of utilities are the objectives of building automation system.

Existing building architectures consumes large amount of energy. Significant amount of energy can be saved by managing the electric consumption in commercial buildings. Because of these issues, the concept of Smart office emerges. This concept of smart office can be applied to whole building, i.e. smart office building which reduces the energy consumption. In this paper, a comprehensive smart office system concentrated lighting, ventilating illuminating, is designed in order to save energy and to promote the satisfactions of the employees. Smart Office Energy Solutions achieves energy savings with a multifaceted approach that capitalizes on human behaviour. By recognizing the

fundamental role humans play in energy consumption, this paper shows the way to reduce it.

II. RELATED WORK

Researchers have put focus on different controlling strategies and have controlled different parameters of smart office. Various parameters, processing's and results of various papers are discussed in this section.

Pellegrino, A. et al has described a system, some results of a project that has been aimed at developing an event–driven system for the management and monitoring of energy consumption in already existing public buildings. The energy aspects are focused, which have been obtained by applying the designed system to monitor and control the different electric lighting systems of different office spaces[1]. Gupta, S.K et al, this system proposes a distributed solution which ensures that among all occupants upon convergence consensus is attained, irrespective of their ideal temperature preferences being in conflict or coherence. The system establishes the convergence of the proposed algorithm to the optimal temperature set-point that minimizes the sum of the energy cost and the aggregate discomfort of all occupants in a multizone building.[2]Jianli Pan et al have built a unique IoT experimental testbed for energy efficiency and building intelligence research. It proposes an IoT framework with smart location-based automated and networked energy control, which uses cloud-computing and smart phone platform technologies to enable multiscale energy proportionality including building, user, and organization level energy in [3].Olivieri, A.C. et al has described the integration of different technologies and protocols remain to date one of the main challenges in IoT. It summarizes an experimental evaluation of integration approach, is based on the implementation of a Smart Office use case in [4].

Tragos, E.Z et al has illustrated a system that presents the functional architecture that provides a framework for interconnecting smart devices efficiently, equipping them with intelligence which helps in automating many of the everyday activities of the inhabitants described in [5]. Afshari, S. et al has proposed a system with plug-and-play capability decentralized feedback controllers for a class of smart lighting systems.[6] Moreno, M.V. et al, this system provides a complete characterization of this building in term of its energy consumption and generate accurate building models which are able to predict the energy consumption given set of different inputs. Finally, considering the generated energy usage profile of the building, some concrete control actions and strategies to save energy[7]. Nelis, J et al,three wireless sensor technologies were investigated to use in the system. The solution was deployed in a " User friendly " setting at a research institute before deployment of system at the large company's premises. Based on the findings of both installations, management of smart (office) and requirements for an application platform to support development and applications were listed [8]. Das, R et al This system discusses a novel approach that using high-performance computing at the primary distribution substation that integrates protection, control, and monitoring level. The business case for infrastructure investment in the distribution systems is also discussed [9]. Mainetti, L. et al, The proposed system deals with the definition of a architecture based on novel rule for the implementation of building automation applications in an IoT context. Sensor data is abstracted at a high semantic level related to the properties they are associated to and interactions with actuators are driven by high-level desired actions[10].

Priller, P et al, this system focuses research and innovation for collaborative automation using interoperable services for high efficiency, smart production, to improve quality, cost competiveness and flexibility [11]. Tseng-Yi Chen et al has proposed a solution for porting uIP library to the wireless sensor network devices and presents the integration of a speaker module and IPv6 ready sensor device. It have also proposed a safe building application based on the integrated system which helps the people to escape from disastorous environmental conditions. In conclusion, this paper's contributions are development of a safe building system to make the concept of IoT in IPv6 network environment come true and bilding an IPv6 ready wireless sensor network environment [12]. Shin, M et al, this system presents the modeling and transient simulation studies of smart building power networks (BPNs) using PSCAD. A typical BPN is modelled based on the real load characteristics of a medium-sized office building and a UPS with multiple static transfer switches is included to protect the system while uninterruptedly feeding critical loads.During the outage ,the simulation results show that the given BPN can remain stable and the effects of the distribution automation on the grid is outlined[13].

Radloff, A. et al , Utilizing the new capabilities of smart meeting rooms, visual outputs of different information representation applications are presented according to the user's needs. This system presents smart interaction management. This interaction approach enables the users to interact with all displayed views, utilizing the novel capabilities of these environments while still being able to interact with applications in a conventional manner using local devices [14]. Jung, M. et al, In this system, building automation devices are considered for an integration in the IoT, where they are example used to realize a smart and sustainable building operation. The concept of building automation systems (BAS) provides ubiquitous access to the objects is facilitated that already provide a virtual representation of physical objects, mainly sensors, actuators and control devices. This system investigates the readiness and compatibility of existing BAS technologies with IPv6[15]. Hennecke, M.H et al ,this system implicitly interacts with multiple users in a smart conference room. This system automatically controls the lighting conditions based on audio source localization and directs the attention of the audience to the active speakers[16]. Bujdei, C.et al This system presents the study on what represents and the possible ways to ensure the indoor office comfort, which is the most important types of comfort (acoustic, air quality, visual, thermal,etc.) and how each of them could be analyzed is shown [17]. Shiquin Shen et al,In this system it proposes a mobility simulation framework based on behavior patterns for office environments. The base

part is simulation time controller, on which it modelled the structure of offices and define behaviour patterns [18].

III. SYSTEM DESIGN

The smart office is designed for users comfort and leisure. It works on automatic and manual mode. In automatic mode the working of system will depend On/off conditions of various sub-systems i.e. lightning and ventilating. The block diagram of smart office system is showed in Figure.1.It consists of various sensors attached to the controller.

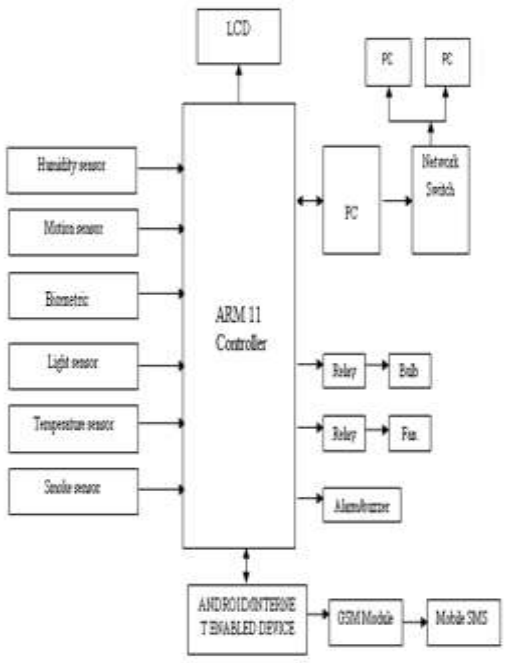

Fig 1: Block Diagram of the System

HY-SS220 Humidity sensor will sense the presence of humidity and that will be displayed on LCD display. PIR Motion sensor will detect the presence of any person and also counts the number of people entered in office. The system will get activate only in presence of person. Fingerprint biometric is used so that any one cannot enter the office. It is used for security purpose. This will allow only office workers to enter in the office. LDR sensor will detect the presence of light. If light intensity increases or decreases below or above some value, the bulb will glow. The system will then automatically adjust the light intensity according to the atmosphere. LM 35 is the temperature sensor used to sense the surrounding temperature. If the temperature increases/decreases the speed of fan will vary accordingly. MQ-7 smoke sensor is used to detect the presence of smoke/fire. Alarm/buzzer will get activate in presence of smoke/fire. If there is presence of smoke/fire message will be send to the Fire extinguisher and to the service rooms so that immediate service can be provided. All the sensed data is send to the ARM 11 Controller. The data is displayed on LCD display.

This data sensed through different sensors is then send to computer and is stored in Office's database.

1) Door access: It comprises of an interlock in the system. When anyone gets into the office building, the system keeps the record of person entered.When all the persons in an office leave the office building, his office door will be locked automatically. Fingerprint biometric is used so that any one cannot enter the office. It is used for security purpose.

2) Lighting: The lights in smart office will be ON when there is darkness in room.. As the light intensity increases above threshold value, bulb will be ON.

3) Ventilating: A carbon dioxide concentration sensor will be used. When the concentration of carbon dioxide reaches certain value, the ventilating machine will be triggered on. Temperature is controlled as per atmospheric conditions. It will be increased/decreased as per need.

4) Smoke /fire detection: Smoke sensor will detect for presence of smoke, if present then the alarm/buzzer will be ON. Simultaneously message will be send to the fire extinguisher and the service room.

IV. PERFORMANCE ANALYSIS

Parameters	Controlling Action
Temp	T>=Threshold, FAN Auto ON/OFF
Light	Light intensity increases, Bulb Auto ON/OFF
Smoke	Greater than threshold, Alarm/Buzzer ON
Motion	Motion Detection

V.ALGORITHM

Office Automation Algorithm:

1) *Start*
2) *Microcontroller Initialization*
3) *LCD Initialization*
4) *ADC Initialization*
5) *UART Initialization*
6) *IO Initialization*
7) *Check for Entry PIR sensor*
8) *If detected, display Person Detected on LCD. Make PIR flag high*
9) *Else display No Person on LCD. Make PIR flag Low*
10) *Select ADC channel 0 for temp sensor*
11) *Wait for ADC conversion complete*
12) *Calibrate temperature*
13) *Check for temp threshold*
14) *If threshold cross, and PIR flag is high Fan ON else OFF*
15) *ADC channel1 select for LDR sensor*

16) *Wait for ADC conversion complete*
17) *Check for light threshold*
18) *If threshold cross, and PIR flag is high Bulb ON else OFF*
19) *ADC channel2 select for humidity sensor*
20) *Wait for ADC conversion complete*
21) *Check for humidity threshold*
22) *If threshold cross, LED ON else OFF*
23) *ADC channel3 select for CO sensor*
24) *Wait for ADC conversion complete*
25) *Check for light threshold*
26) *If threshold cross, Buzzer ON else Off*
27) *Send all sensors data to serial port0*
28) *Display it on GUI*
29) *Send all these values to WAMP server*
30) *Access this info on another Wi-Fi enabled devices*
31) *Repeat steps 8 to 30*

VII. CONCLUSION

In this system, close attentions are given to user's comfort and satisfaction. The illuminating, lighting, heating, ventilating ,door access, smoke detection systems are being designed. The smart office system in the system is based on an independent smart office and then expanded to the whole smart building. In this smart office system, two working modes automatic mode and manual mode are use. The manual mode is viewed as a supplement of the automatic mode.

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This study is useful for the smart automation systems for office environment and in understanding the different subsystems for office use by using ARM controller and it is used to reduce the power consumption.

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