Cloud Based Property Management System in Integration with IoT

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Abstract: Cloud based Property Management System (CPMS) is one of the best data management software that assist in managing the hospitality sector by undertaking reservations, providing discount allocation and handling capacity management for generating revenue, it also assist in gaining the loyalty of guest by communicating with sensors for guest security and comfort using Internet of Things (IoT). Nevertheless the knowledge of employees by being as source of information in hotel Industry, CPMS stores the data in a cloud server in order to keep this data safe. The main objective of this study is to find the association between CPMS with IoT for business and trust perspective. Secondly it focuses on the deployment of sensors and actuators in the infrastructure facilities that are integrated with Property management System (PMS) in luxury hotels, which simultaneously increases the hotel room revenue with consequent future concerns. Thus this investigation provides an effective operational decisions has to be taken by authorities on installation of cloud based PMS that can coordinate with OTA using Application Programming Interface (API) to increase the business with safety and security.

Keywords: Cloud Applications, PMS, IoT, Revenue Management.

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1. Introduction

The CPMS is widely used in hospitality sector to accomplish the basic objectives like reservation, registration, cash settlements, capacity management and Discount allocation. The hospitality sector dependent on CPMS for day to day activities on managing the property by arranging facilities and record keeping in various modules [1]. As the activities center, the PMS interfaces with a few sections and segments inside the hotel framework [2] like the automated door locks, thermal and movement sensors of room communicates the presence of guest in room and the health conditions through embedded or wearable body sensors using Wi-Fi systems, and other guest administration applications developed for international group of hotels, like contactless check in and check out as a preventive measure for post Covid 19 simultaneously hotel services and menus are available in digital platforms to meet the current trend, hotel guest can make the contactless payments using mobile applications, which is supported by CPMS [3]. Adding to the intricacy, the links outside associates assist in hotel bookings for instance airlines companies and Online Travel Agents (OTA) also associated with the CPMS. The various functions of hotel is supported by CPMS integrated with IoT built Infrastructure could give a more extensive information about the health of hotel guest using networked sensors [4]. The data communicated from various sources will be stored in remote server. Regardless of whether room reservations come from OTA, Global Distribution Systems (GDS) or by telephone, In light of industry research and in a joint effort of hospitality sector, implementation of CPMS is a beginning task that expects to help accommodation associations to execute more grounded safety efforts inside and around the property, with an attention on the POS framework through system division, highlight point encryption, information tokenization, multifaceted confirmation for far off and accomplice access, system and client conduct investigation with automated electronic room key generator from CPMS may assist the hotel in providing privacy and security for guest [5]. The IoT network has actualized the principles that improve cyber security for software and mobile app safety by means of API [6]. This venture will create Cyber security Practice leads to an openly accessible depiction of the arrangement and functional advances expected to successfully make sure about the CPMS and its numerous modules to work inside the property framework [7]. Thus to enable the technology in to hospitality environment, a typical stage on the cloud must be arrangement to empower information correspondence among applications. Dynamic information can be compatible for employees and all customers ought to have the option to get the necessary information for business anticipation and the tactical plan related to enhance the abilities. Taking care of huge information about customer details requires a keen frameworks which ready to extricate, change also, examination mixed information from interior and outside sources. The IoT technology associated with applications utilizes some unique sensors together for fundamental preprocessing and neighborhood capacity of the gathered sensor information. On the off chance that the IoT gadget consolidates short range correspondence that advances as a gateway gadget which empowers synchronization of gathered information with cloud-based Web backend framework. Such a passage is frequently actualized as a cell phone or work area application. Synchronization for the most part requires almost no client mediation. The cloud backend framework stores, forms, examines and imagines the gathered information.

2. Materials & Methods

The primary data has been obtained from a structured questionnaire prepared for the guest who is checked in to hotel and utilizing the facilities and the secondary data is obtained from online with literature reviews. Thus a questionnaire is prepared based on the features of CPMS with the combination of IoT, The sample size is measured as 50 around 40 is used for this study. The Statistical analysis is done by using SPSS tool.

3. Results & Analysis

3.1 Correlation

TABLE 1. CORRELATION OF CPMS INTEGRATION WITH IOT

Correlations		CPMSWITH EMS	PMS IN USE	PMS WITH IOT	EDLS
CPMSWITHEMS	Pearson Correlation	1	.782**	.734**	.429**
	Sig. (2-tailed)		.000	.000	.006
	N	40	40	40	40
PMS IN USE	Pearson Correlation	.782**	1	.859**	.562**
	Sig. (2-tailed)	.000		.000	.000
	N	40	40	40	40
PMS WITH IOT	Pearson Correlation	.734**	.859**	1	.632**
	Sig. (2-tailed)	.000	.000		.000
	N	40	40	40	40
EDLS	Pearson Correlation	.429**	.562**	.632**	1
	Sig. (2-tailed)	.006	.000	.000	
	N	40	40	40	40
**. Correlation is significant at the 0.01 level (2-tailed).					

This table 1. States the IoT correspondence with CPMS in regard the embedded sensors and actuators at hotel infrastructure for managing the energy, in addition to that the Electronic door locking systems (EDLS) controlled by the PMS in use at hotel properties. As this correlation results proves a good association between the PMS used in hotel and the CPMS with Energy Management System (EMS) by a significant value $p = .000$ and a value $r = .782**$. There is a strongest relationship is noticed with the type of PMS used in Integration with IoT by having the value $r = .859**$ and a significant value $p = .000$. This results also shows that the luxury hotel properties are using the PMS which is unified to control electronic door locking systems, since the correlation between EDLS with PMS in use has a value $r = .562**$ with a significant value $p = .000$ that determines most of luxury hotel properties enabled with EDLS. The building infrastructure is one of the fundamental requirement for critical units for human's living in today's condition. The perception behind intelligent infrastructure is begins with the expansion in mix of cutting edge innovation to architecture and their frameworks with the end goal that the entire operations could be remotely worked and controlled during accommodation, to provide luxury and expediency in an expense and vitality effective way using EDLS. It is generally acknowledged that the utilization of new advanced technology like IoT is an essential tool to accomplish the acknowledgment of Smart Infrastructures [8]. The interlinking and ability of IoT is becoming pervasive in hospitality sector as a knowledge framework that will refashion this industry. A completely coordinated savvy system ought to be ready to detect, store, examine and decipher information progressively. From the ability of IoT and sensors, information the outer condition can be supervised and alienated [9]. Vitality Management Systems allude to those arrangements which empower inns to decrease unneeded vitality utilization, regularly identified with lighting and additionally warming. They allude both to Software and Switches, and incorporate a wide scope of gadgets and work in different territories of the lodging, notwithstanding, they are mostly centered on the vitality the board of visitor room [10]. This can be worked from a PC terminal, which thusly can be interfaced with the PMS, and give extra highlights. This may incorporate an indoor regulator which empowers the property to misfortune the room temperature when this is abandoned, and handles the temperature control to the visitor when the room is utilized. Further energy control is given through their concentrated rendition, which interfaces the framework to the PMS what's more, empowers further functionalities, for example, naturally lighting up the room at the point when the visitor checks-in so as to produce an inviting environment. Hotels could sanction a few cost-sparing measures in the organizing on-property energy utilization by IoT innovation, as these measures are especially useful in accomplishing energy saving activity, it will be a best option for environment friendly at on-property frameworks.

TABLE 2. CORRELATION BETWEEN PMS INTEGRATION WITH SENSORS

Correlations		HEALTH SENSORS	THERMAL SENSORS	EMBEDDEDSENSORS	CPMS WITH IOT
HEALTH SENSORS	Pearson Correlation	1	.907**	.729**	.760**
	Sig. (2-tailed)		.000	.000	.000
	N	40	40	39	40
THERMAL SENSORS	Pearson Correlation	.907**	1	.651**	.750**
	Sig. (2-tailed)	.000		.000	.000
	N	40	40	39	40
EMBEDDEDSENSORS	Pearson Correlation	.729**	.651**	1	.863**
	Sig. (2-tailed)	.000	.000		.000
	N	39	39	39	39
CPMS WITH IOT	Pearson Correlation	.760**	.750**	.863**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	40	40	39	40
**. Correlation is significant at the 0.01 level (2-tailed).					

Table 2. Displays the association between PMS and Sensors deployed at the infrastructure facilities of hotel properties, there is a strongest relationship identified from thermal sensors and health sensors with a value r = .907**, the value is significant by p = .000. Secondly this correlation is also significant by having a stronger relationship between PMS and Embedded Sensors with a value r = .863** and a significant value. P = .000. Thus this results substantiates that the infrastructure facilities of hospitality industry has deployed the sensors and actuators, which is integrated with PMS.

3.2 Linear Regression

This statistical analysis determines the dependent and independent variables with its relation so a linear regression is done to identify the association between the dependent variable PMS with IoT along with the independent variables like WIFI Connection, Thermal Sensors, EDLS and Embedded Sensors. The deployment of sensors at infrastructures could be controlled by software's, the PMS is evidencing the relation between the sensors for EDLS, comfort, safety, security and for health. As most of the luxury hotels using WIFI connection to enable and communicate with these sensors and actuators, there is a greater significance between these variables.

TABLE 3. SIGNIFICANCE OF DEPENDENT VARIABLE FROM PREDICTORS

ANOVAa						
Coefficientsa						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	19.941	4	4.985	70.089	.000b
	Residual	2.418	34	.071		
	Total	22.359	38			
a. Dependent Variable: CPMS WITH IOT						
b. Predictors: (Constant), WIFI CONNECTION, THERMAL SENSORS, EDLS, EMBEDDED SENSORS						

The results obtained from anova shows a substantial link between dependent variable CPMS in integration with thermal sensors, WIFI connection, EDLS and embedded sensors. As the results shows a significant value P =.000b this test proves that the CPMS are integrated with IoT. The intensifying space for networking in global scenario is attained by sensor frameworks. This approach is associated with sensor, actuator, and electronic gadgets in combination with exemplary system foundations at an Infrastructure facility. These systems can fill in as foundations to progressively incorporate, sensors and actuators into complex intelligent frameworks while offering helpful types of assistance and interfaces to clients. A conspicuous situation for pervasive registering and improvised systems administration.

TABLE 4. DEPENDENT VARIABLE PMS WITH IOT COEFFICIENTS

Coefficientsa					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-.219	.145		-1.506	.141
THERMAL SENSORS	.271	.073	.310	3.692	.001
1 EDLS	.408	.124	.286	3.299	.002
EMBEDDEDSENSORS	.379	.126	.417	3.006	.005
WIFI CONNECTION	.129	.137	.133	.939	.354
a. Dependent Variable: PMS WITH IOT					

The table 4. Specifies PMS integration with IoT is proved to be significant with this regression results as the coefficients are positively associated with a value (b = .271, p = .001), which indicates that these coefficient thermal sensor is mutually linked. The EDLS and PMS is showing a good association with the results (b =.408, p = .002) this value evidences the luxury hotel properties are deployed sensors and actuators for EDLS facility with the combination of PMS. The Values are similar for Embedded sensors with PMS as (b = .379, p = .005). As the majority of these sensors and actuators requires a WIFI facility the relationship between WIFI connection and PMS is also having a good significance with a value (b = .129, p = .354).
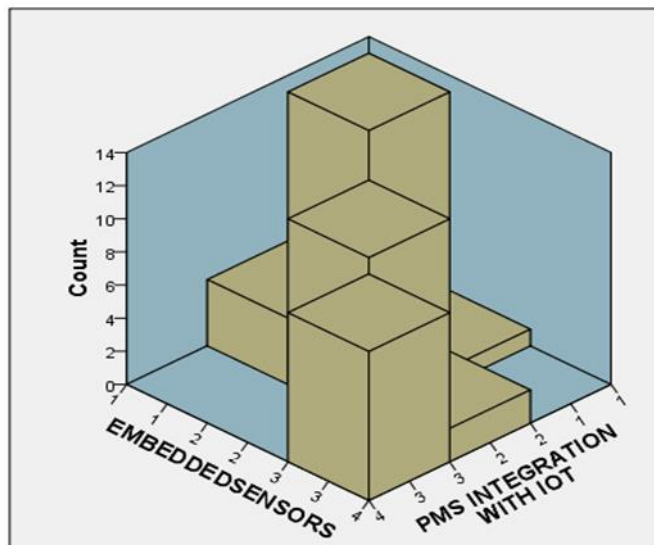
FIGURE 1. PMS WITH EMBEDDED SENSORS

Figure 1. States the existence of embedded sensors in hotel properties in integration with PMS as the luxury hotels is focused on EMS vitality with occupancy sensing sensors as an approach to contend, here the option 3 shows the hotels rooms enabled with embedded sensors as to convey the best an enticement to their clients. In the interim, the harmony between visitor comfort and operational effectiveness is getting more testing than any time in recent trend. Hotels are understanding that it's difficult to acquire satisfaction without an improved visitor experience based on a technology that precisely identifying movements in the visitor room. A thorough movement detecting methodology is important to understand the full advantages of an EMS framework. Thus the embedded sensors are used to sense the occupancy of guest which also possible by infrared sensors and Heating Ventilation and Air conditioning System (HVAC) system. Although Passive Infrared Sensors (PIR) is in use. This statistical analysis demonstrates the usage of sensors at infrastructure facilities and also determines the hotel PMS is integrated with IoT. A few of the EMS systems at present set up at numerous properties to incorporate Intelligent lighting and temperature control frameworks just as utilization of minimum energy consumption gadgets like LED and CFL lights and so forth. IoT innovation can fundamentally extend the extent of EMS systems with IoT-driven electrical units and IoT-empowered smart gadgets, it could also be utilized to confine water utilization. This can be accomplished through IoT- enabled restrooms with automatic shower control, Intelligent sinks and so on.

4. Conclusion

This exploration from this study focused around the utilization of virtual cloud based PMS joined with IoT framework with sensors and actuators. The execution of the significant CPMS combined with the IoT for operational procedure and operational execution of the luxury hotels. This contextual investigation presents the

luxury hotel properties are deployed sensors at their infrastructure through the coordination and advancement of cloud IoT innovation. The correlation results are significant at 0.01 level, for the relationship between CPMS and EMS and proves that the hotels are using cloud based PMS with IoT advancements. This study also reveals that the hotel rooms has embedded sensors through a greater significance r = .907**, the value is significant by p = .000. The nature of IoT correspondence with PMS has picking up its significance in accommodation industry with a quick pace in the ongoing occasions. There is a change in perspective rehearsed in the industry due to the reception of Information and Communication innovation and the electronic media. There has been heaps of changes in the manner accommodation items and administrations were offered and the separated from operational changes. The major procedure of collaboration and interface between the PMS and IoT to provide a personalized experience in smart hotels for a improved client acceptance. The CPMS also supports in developing the hotel experience through various application in combination with OTA and mobile apps.

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