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Study on Smart Designed Power Monitoring System Using IoT Devices

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Abstract: This study has clearly proved that a well-designed power monitoring system is quite effective and necessary in the current year. During the same time, the integration of IOT devices with this system increased its effectiveness and use in a variety of disciplines. On the other hand, using this monitoring system makes it simple to maintain direct and effective connection with GSM and embedded controllers. Several sensors in smart design monitoring systems come in handy in this circumstance. Aside from that, the study's critical discussion revealed that smart power monitoring systems have a favourable influence on motion direction, home security, augmented reality, and technological disruption. The researcher gets data from 100 respondents out of a total population of 500. The sample for the study is chosen by the researcher using the basic random selection approach. The researcher prefers simple random sampling because it is the simplest way for selecting samples for the study. The researcher distributes the questionnaire to the study's respondents and so collects their responses in order to perform the research.

Keywords: Power Monitoring System, Energy Consumption, Smart Design, Home Security System, Sustainability, Monitoring System, Motor Direction, Technology Disruption.

I. INTRODUCTION

The "Smart energy management system" is considered to be one of the most enabling technologies which helps in leveraging the connectivity that is posed by IOT bringing back the measurement track and control that optimises for consumption of energy through building of certain complexes [1] [2]. The "Smart Design Dower Monitoring System" helps in providing communication with the GSM modem with the embedded controller, which helps in transmitting the data [3]. This system also consists of the motion sensor which helps during the time when there is no human in the house and there is an automatic power cut [4] [5]. The energy saving is considered to be one of the most significant in challenging issues. The "Automatic Electrical Power Metre" is utilised in the power distribution system of domestic electricity [6]. This type of system helps in communication with the embedded controller and the GSM more than that helps in transmitting the data. This system also consists of a sensor that has motion such that it automatically works in power supply cut [7] [8]. The domestic consumers also enjoy the benefit through this system [9].

The aim of the research is to analyse the use of IOT devices on the system of "Smart Designed Power Monitoring".

RO1: To analyse the impact of home security on smart power monitoring system

RO2: To study the effect of motion detection on smart power monitoring system

RO3: To evaluate the effect of augmented reality glass on smart power monitoring system

Research Hypothesis

DV: Smart power monitoring system

IV: Home Security, Motion Detection, Augmented reality glasses

MV: Technological disruption

H1: Home security have a direct and significant impact on smart power monitoring system

H2: Motion detection have a direct and significant effect on smart power monitoring system

H3: Augmented reality glass have a direct and significant impact on smart power monitoring system

H4: Technological disruption mediating effects the association between home security and smart power monitoring system

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H5: Technological disruption mediating effects the relation between motion detection and smart power monitoring system

Therefore, it is considered to be significant to study about the provided topic since it helps the researcher to understand the various methods in which the companies can make use of the IOT devices to develop the smart design monitoring systems [10]. Therefore, the IOT devices are considered to be significant for the companies to have an effective function to give the resultant outcomes in an easier manner without any delay.

II. LITERATURE REVIEW

A. Theoretical Underpinning

Technology acceptance model postulates that technology acceptance is anticipated by the behavioural intention of the users [11]. This, in turn, is defined by the technology's usefulness perception in functioning the activity and perceived ease of its usage [12]. This is to offer a foundation for tracing the external variables' impact on internal intentions, attitudes and beliefs [13]. Smart grid is simply a renewable energy wherein potential consumers to adopt and use this technology is challenging. A study conducted by McKinney found that around 15,000 people across 10 nations claimed that around 30 percent of those never heard about the term of this energy and over 60 percent do not understand properly about this energy [14]. For acceptance of this renewable energy, consumers are quite particular regarding the cost as well as privacy issues related to this [15]. They further concern the provision of electricity to the vulnerable and poorer part of the population [16].

B. Definition of Variables

Smart power monitoring system is a technology, which leverage the connectivity that the IOT brings to measure, track, optimise and control energy consumption through any offices or buildings [17]. This technology is cost saving, helps in reduction of carbon emissions, beneficial in asset maintenance, energy saving and beneficial in instant changes and continuous monitoring [18]. According to TAM, the implementation of this technology can help business to better identify problems [6].

The main purpose of TAM is to accept the new kind of technology and its related tools. All of these allow any nature of business to boost up their business process over the coming years [4] [19]. Therefore, it can be said that this theory also has a positive association with smart power monitoring systems. On the other hand, by using this model any organisation and its management can monitor their smart energy system, which enhances their energy consumption system [17] [20]. Apart from this, by applying the principles of this implementation model it becomes easy to utilise smart power monitoring systems in an efficient way.

The intelligent energy administration system has been regarded as a single of the greatest innovative technologies that assists in utilising the links provided by the Internet of Things and returning home the ability to tracking and management that improves for energy consumption through the construction of specific buildings. The cellular modem with the integrated microcontroller that aids in data transmission can be communicated with thanks to the sophisticated power-monitoring device. The system in question also has a motion sensor, which is useful when the system detects no one home and the electrical supply is automatically off. The ability to save energy is regarded as one among the most important solutions to difficult problems.

Home security includes both the safety hardware, which is incorporated on any property as well as a person's personal safety practices [21]. Smart home wise technologies help in monitoring the intake of electricity power along with imparting protection. Family safety and home protection are the key intentions of any security systems [22] [23]. Smart home security system such as home alarms allow a person to monitor, arm and disarm the home alarm from everywhere [24]. This further employs a vast array of IOT-enabled products to allow users to manage and monitor remotely their home securities.

However, it has also identified the main concept of this implemented model to encourage the user to accept technological disruption [13] [25]. Home security system is also one kind of technological disruption, which makes the process of home security more efficient and effective than before. In this case, the TAM model helps the authority of any home to monitor their residence when they are staying far away from their house [26] [6]. Generally, all kinds of new home security tools guide the home authority to accept these kinds of tools [27] [26]. In this way, this undertaken theory also helps to improve the home security system in a correct way and get many benefits from this home security system.

Motion detection is a method of identifying any changes in an object's position [28]. This IOT device is additionally very much effective in smart design power monitoring system. Motion detectors generally utilise PIR (Passive Infrared) or ultrasound technology in order to detect any motion [29] [30]. The key purpose of this IOT device is to sense any intruders and then send a warning alert to the control panel, which further alerts the power-monitoring centre [26].

This technology related model TAM also provides two kinds of effective principles such as perceived ease of use and perceived usefulness [20] [10]. Both of these principles are related to the motion direction. Following this variable, it has determined that it is important to use the smart design monitoring system like smart energy systems with the right direction. In this case, motion directors provide detailed

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guidelines regarding the use of smart energy systems. These guidelines help to find out the perceived usefulness of this monitoring system [11] [14]. Consequently, the TAM model and motion director both linked with each other under the smart design monitoring system.

Augmented reality smart glasses are computer-capable wearable glasses, which add additional data, primarily three-dimensional images and data like videos and animations [31]. For example, Hexagon's augmented reality smart glass-monitoring solutions utilises AR in order to assist manufacturing operation via maintenance process and key operations [32].

It is very important to focus on the users' willingness, perception, attitudes during the time of using any kind of new technology [15] [26]. Here, the implementation of the TAM model becomes very helpful for this proposed study. Here, by the help of this model it is possible to identify all kinds of factors related to augmented reality smart glasses. On the other hand, the willingness, intention, and usefulness of this glass to the user can be determined [29]. Due to all of these reasons, the TAM model is related to this variable and improves the significance of this variable with the proposed study [33].

A technology disruption happens when an innovative component of technology changes the extent and way industries, consumers and businesses operate. Disruptive technologies frequently develop an emerging market when they are first developed [34]. This further offers opportunities for any start-up firms to accomplish a substantial foothold in current sectors [13]. IOT based smart power-monitoring system is one such innovative technology that automates the key procedures for businesses [34].

The concept of disruption in technology and the TAM model are quite similar to each other [4] [35]. In this case, the TAM model also promotes all kinds of new technology. On the other hand, technology disruption also allows the user to undertake the perceived usefulness of new Innovative technologies [10] [23]. Apart from this, any kind of IOT based monitoring system can be implemented and applied by the user within their organisation by help of this model.

C. Hypothesis Development

H1: Home security have a direct and significant impact on smart power monitoring system

The main purpose of home security systems is to control quick and detailed communication between the central station of the security provider and the home security system [5]. Apart from this, with the help of this system it becomes possible to respond quickly against any emergency event by which the management of home can resolve any issues by appropriate guidance of authorities [36]. Along with this, smart power monitoring systems can save the energy consumption system within any home and help to save money during the same period [8]. Therefore, home security has a significant and direct impact over the smart power monitoring system. Technological disruption in the context of smart-home power surveillance systems occurs when a cutting-edge technological element alters how organisations, customers, and sectors function. During the time of its creation, smart home power monitoring systems usually experience a developing market [37]. This provides additional chances for any new businesses to establish a strong presence in active industries [13]. One such innovative innovation that streamlines crucial corporate processes is an IOT-based smart power monitoring system.

H2: Motion detection have a direct and significant effect on smart power monitoring system

Smart motion detection system is formulated in terms of measuring both movement and heat over time, which further help in reducing false alarms [38]. In smart power monitoring systems, motion detectors enhance safety, save energy, deliver more convenience and light up challenging areas [39]. Apart from this, it also provides direct guidelines and framework so the energy consumption can be conducted in a systematic way by smart power monitoring system [40]. Smart motion detection systems' primary function is to regulate prompt and thorough interaction among the house's surveillance system and the safety supplier's main unit. In addition, this technology enables prompt response to any situation of emergency, enabling the leadership of the residence to address any problems under the proper direction of officials [46]. Additionally, intelligent motion detection may decrease the power usage device in every house while also contributing to financial savings. As a result, the smart energy management system is significantly affected by smart recognition of motion.

H3: Augmented reality glass have a direct and significant impact on smart power monitoring system

In smart power monitoring systems, augmented reality glasses address the challenges by adding value on smart metres [41]. This further helps in reducing the concerns linked with smart energy metres and assists in maintaining and planning the process of this technology [2]. Apart from these, application of augmented reality glasses in smart power monitoring systems also reduce the time for maintenance and deployment [42]. This method was improved and rendered easier to use in a variety of industries by the addition of internet of things (IOT) gadgets. However, it also gets simple to keep a simple and efficient connection with embedded systems and Smartphones using this tracking method. A number of sensors in smart design monitoring systems additionally come in handy in this situation [38]. In addition, it has been determined that smart power-monitoring systems positively affect movement guidance,

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safety at home, virtual realities, and disruption in technology. Furthermore, the direction of motion and security in homes are both impacted by technological disruption.

H4: Technological disruption mediating effects the association between home security and smart power monitoring system

Technological disruption brings advanced IOT based home security and advanced power monitoring systems [30]. It further offers advanced IOT based home security devices, which guarantee and address safety or security concerns [25]. Smart power monitoring systems enhance customer loyalty and help firms to make a profit, thanks to technological disruption [19]. When utilising any new technology, it is crucial to pay attention to user willingness, thinking, and attitudes. For this proposed study, the use of the technology disruption is highly beneficial. Here, with the aid of technological disruption, it can be done to pinpoint a variety of elements relating to intelligent glasses for the use of augmented reality [38]. On the other side, it is possible to assess the user's commitment, motive, and utility with regard to this glassware. All of these factors make the technological disruption relevant to this factor and enhance its relevance in the proposed research project.

III. METHODS

A section in which the researcher discusses the various methods and procedures will be utilised by him to conduct the research [23]. Research philosophy is the emotion or belief that the researcher would follow while conducting the study. Three philosophies can be used by the researcher [43]. The study is conducted by using the positivism philosophy and not the other two, which includes realism and interpretivism philosophy [11]. The researcher prefers to make use of the positivism research philosophy since it provides a researcher with accurate and appropriate results for the study. The researcher also chooses to utilise the deductive approach for conducting the study [44]. Research approach is considered as the plan or technique that can be utilised by the researcher to conduct the research. The researcher prefers to use deductive approach rather than the inductive approach since it helps the researcher to obtain the result of the study in an easy manner [45].

Research design also provides the researcher the structure or framework that is utilised by him to conduct the study. The researcher selects the descriptive research design to conduct the study since it seems to be easy and simple to the researcher. Moreover, it provides the researcher with the description of the methods that are utilised by the previous researchers [34]. The researcher collects data from 100 respondents from a population of 500 respondents. The researcher selects the sample for the study by using the simple random sampling method. The simple random sampling is preferred by the researcher since it is the easiest method to select samples for the study. The researcher distributes the questionnaire to the respondents of the study and therefore collects their responses to conduct the research [10]. The questionnaire is distributed among them using online surveys and their responses are analysed and evaluated to obtain the best results for the research.

Data collection is one of the crucial methods in research methodology. This research method helps this study to collect accurate and relevant information, which are very effective for this study [46]. Two kinds of data collection methods are primary and secondary data collection. Among all of these here selected primary data collection methods like survey. Following the primary data collection method, this study collected information from 100 employees who are associated with smart designed power monitoring systems. However, this study has developed a questionnaire based on primary data collection method [47]. Therefore, through the help of primary data collection methods it becomes easy to gather information directly from the real field [48]. Consequently, different kinds of information about smart designed monitoring systems, home security, and importance of technological disruption gathered by this data collection method.

After the collection of information, it is crucially important to sort, cleansing and interpret the data. Therefore, the data analysis method is very important for this study. Quantitative, qualitative, and thematic are different kinds of data analysis methods. In this study, quantitative data analysis method was chosen for this study [49]. Based on quantitative analysis, this study interprets all of the information such as the significance of the home security system, importance of technological disruption in a numerical way. Additionally, IBM SPSS software has been implemented here to test the developed hypothesis and its variables [50]. Additionally, this software tool is applied here as an instrument which helps to determine duplicate and irrelevant information [51].

In order to conduct the study in a proper way it is very important to follow all kinds of ethical guidelines and principles [52]. Here, the “Data protection Act 2018”, in Malaysia, was selected as an ethical act [53]. Following the principles and norms of this act, this study ensures the respondents that not all of the collected information was shared to anyone without their permission.

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IV. RESULTS AND DISCUSSION

TABLE I. PARAMETERS

		Count	Column N %
Gender	Male	74	74.0%
	Female	25	25.0%
	Prefer not to say	1	1.0%
Age	25-35 years	69	69.0%
	35-45 years	22	22.0%
	45-55 years	5	5.0%
	Above 55 years	4	4.0%
Yearly income	100000-200000	82	82.0%
	200000-300000	10	10.0%
	300000-400000	3	3.0%
	Above 400000	5	5.0%

TABLE II. ITEM STATISTICS

	Mean	Std. Deviation	N
Enhance the home security system	1.3600	.70381	100
Watch their residential	1.3200	.64948	100
More beneficial rather than traditional security	1.3300	.65219	100
Monitoring process at home	1.4100	.82993	100
Smart anti-theft system	1.3500	.67232	100
Easier to use	1.3500	.67232	100
Identify nearby motion	1.3300	.60394	100
Electronic or mechanical methods	1.3400	.69949	100
Infrared sensor employing IOT	1.3400	.72780	100
Detect snot if every activity	1.3500	.78335	100
Sending information wirelessly	1.3700	.78695	100
Prevent theft and burglary	1.2900	.67112	100
Overlay instructions on the displays and image	1.2900	.71485	100
On-site machinery	1.3300	.72551	100
Acquired at are regarding equipment functioning	1.3600	.81054	100
Supporting new field workers	1.3200	.77694	100
Remote specialist feedback	1.3200	.72307	100
Effectively manage 3D and blend digital components	1.4300	.85582	100
Technological adoption exposes an atmosphere of new market	1.3700	.77401	100
Optimise and reduce the level of power consumption	1.4500	.96792	100

TABLE III. RELIABILITY STATISTICS

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.758	.761	20

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TABLE IV. COEFFICIENTS

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	.999	.515		1.940	.056	-.026	2.025
	Enhance the home security system	.370	.154	.269	2.404	.019	.064	.677
	Watch their residential	-.291	.196	-.195	-1.484	.014	-.680	.099
	More beneficial rather than traditional security	-.184	.169	-.124	-1.087	.028	-.520	.152
	Monitoring process at home	-.133	.135	-.114	-.982	.329	-.402	.136
	Smart anti-theft system	-.346	.208	-.240	-1.660	.010	-.760	.069
	Easier to use	.061	.187	.042	.325	.746	-.311	.433
	Identify nearby motion	-.092	.192	-.058	-.481	.632	-.475	.290
	Electronic or mechanical methods	-.244	.182	-.176	-1.345	.018	-.605	.117
	Infrared sensor employing IOT	.240	.168	.180	1.427	.016	-.095	.575
	Detect snot if every activity	.104	.177	.084	.588	.558	-.248	.456
	Sending information wirelessly	.098	.191	.080	.515	.608	-.281	.478
	Prevent theft and burglary	.047	.176	.032	.265	.791	-.304	.398
	Overlay instructions on the displays and image	.330	.186	.244	1.771	.080	-.041	.700
	On-site machinery	-.022	.156	-.017	-.143	.887	-.332	.288
	Acquired at are regarding equipment functioning	.110	.152	.092	.724	.471	-.192	.411
	Supporting new field workers	.012	.156	.009	.075	.941	-.298	.321
	Remote specialist feedback	-.083	.185	-.062	-.449	.655	-.451	.285
	Effectively manage 3D and blend digital components	.232	.141	.205	1.643	.104	-.049	.513
	Technological adoption exposes an atmosphere of new market	.114	.140	.091	.817	.416	-.164	.393

Dependent Variable: Optimise and reduce the level of power consumption

One of the additional statistical methods amongst all of the additional quantitative techniques is descriptive analysis [54]. This analysis of the methods used to quantify specific sensory aspects in research includes participants [55]. Whilst the researcher has been gathering particular information, this testing method also has the capacity to detect and record human

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emotions [56]. The researcher's full data set has a substantial advantage when a descriptive analysis is conducted [57]. The researcher gets the chance to identify trends and connections among all of the variables already incorporated into the current study through this analysis. The male percentage for the poll is 74.0%, while the female percentage is 25.0%. It can also be noted that the age groups 25-35 years are 69.0%, 35-45 years are 22.0%, 45-55 years are 5.0%, and over 55 years are 4.0%. For the analysis of quantitative data component of the research study, the researcher's whole collection of information is typically viewed as being of utmost importance [58]. The assumptions that may indicate particular kinds of errors throughout a model of regression are referred to as "attributes of normality." Homoscedasticity refers to the fluctuations of the erroneous phrases that can all be viewed as independent variables. This is additionally considered essential since it allows the researcher to draw attention to inaccurate and deceptive references used in the study [59]. Non-response bias is believed to exist when individuals fail to respond to the survey's custom-made questions. The study's Cronbach alpha score is 0.758, which means that the data it collected are quite reliable, as seen from the aforementioned finding. According to the aforementioned item statistics and coefficient, the majority of the statistically significant values are below 0.05 (alpha value). As a result, it can be claimed that the study's main hypothesis has been met.

V. CONCLUSION

This study has critically demonstrated that a smart designed power monitoring system is very effective and essential for this recent year. During the same period, the combination of IOT devices with this system made it more effective and beneficial in different kinds of fields. On the other hand, with the help of this monitoring system it also becomes easy to maintain direct and effective communication with GSM and embedded controllers. In this case, several sensors in smart design monitoring systems also become helpful. Apart from this, from the critical discussion of this study it has been identified that smart power monitoring systems have a positive influence over motion direction, home security, augmented reality and technological disruption. Additionally, disruption of technology has an impact on both home security and motion direction. In order to collect information regarding all of these factors here has selected 100 employees who are aware about smart designing systems. During the same period, for the interpretation of the information IBM SPSS software chose for this proposed study.

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