Analysis of Sensors Used to Make Smart Homes

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ABSTRACT— One of the most widely used Internet of Things applications is home automation. There has been a huge shift in the way humans live their lives, making it easier and more beautiful. It aids in the discovery of easy answers to a wide range of difficult problems. Every application of home automation is linked to the others through the Internet. All of these applications are interconnected through sensors. These sensors can be used to operate a variety of devices, including doors, fans, lights, gas, televisions, refrigerators, and air conditioning. As a result, there is no requirement for human intervention. Our homes have become exceedingly safe thanks to the use of sensors. So that if there is an accident, we will be able to detect it from a long distance without difficulty. It is also capable of preventing unintended mishaps with the use of this technology. The most important thing to understand is which sensors will be used to create this smart house. Aspects such as finances are taken into consideration so that we can use the sensors to build smart houses as needed. This paper describes a technique for smart home automation that is low-cost and wireless, and it makes use of several types of sensors and the Internet of Things to accomplish this. Following extensive investigation, we develop a viable prototype. Specifically, we are interested in suggestions about what types of sensors are utilized to create a smart house, how much they cost, and a thorough understanding of how the sensors are used for various purposes.

Keywords— Smart Sensor, IoT, Home Security, Automation, Wireless Sensor Network

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I.INTRODUCTION

In order to improve the overall quality of life, smart home technology provides cutting-edge services and collaboration. Sensors automate the entire house, allowing us to perform all we need to do with relative simplicity. With the use of sensors, the entire house is transformed into a robotic system, causing the house of our choosing to change its shape. It will soon be evident that electrical equipment are taking use of technology through the use of sensors, which will make our daily tasks easier to complete. Sensors used in the home reduce the amount of work done by humans. Smart home technologies are being employed more frequently in the kitchen and living room at the moment. The sensors that are utilized in smart homes make the home incredibly safe and secure, and they also play a significant part in lowering other costs, such as electricity consumption. People with disabilities, in addition to all of the above, are provided with benefits. This has been a common practice in smart homes for quite some time now. Every day, modern technology is making its way into people's homes. New sensors can be utilized to make timely adjustments to a home, allowing it to be transformed into a contemporary smart home.

Previously, sensors were added to it, but now the vast majority of the sensors are wireless. As a result of rising research standards, advanced sensors are being developed, and advanced smart houses are being built with the assistance of these sensors. Sensors are currently giving improved benefits at a lower price point than in the past. In addition to smart homes, millions of sensors are being employed in agricultural, entertainment, health and safety applications as well as in other fields. As a result, the overall quality of life is improving. And, in order to reap the benefits of all of these advantages, it is critical to choose the most appropriate sensor. The most important goal is to be able to take advantage of the sensors by picking them as needed when they are available. The primary goal of this study is to demonstrate that we can develop smart houses by utilizing the appropriate sensors to the greatest extent possible.

II. LITERATURE REVIEW

People's homes are where they live and where they spend the majority of their time. Leisure activities, independent decision-making, well-being, reading and learning are some of the things they do during this time, as well as several other home chores. Everyone want a home that

is both smart and secure, and that they can call their own. They will not have to be concerned about their safety or their ability to live peacefully as a result of this. Since the dawn of time, scientists have been conducting research into smart home control systems. The development of new sensors is boosting the overall quality of our lives, according to scientists. Everything is becoming more and more automatic. For example, a ZigBee-based wireless smart home that is capable of functioning properly and that can be operated using the Android operating system. More studies on home automation have been published in recent months (*#1 in Smart Home Solutions & Home Automation » Hogar Controls, India*, n.d.). More studies on home automation have been presented in the past few weeks. The technology is particularly intended for children with disabilities, and it allows them to have complete control over their surroundings. A piece of paper that can be used to manage the entire house using voice commands. However, there is a difficulty with it that only pertains to persons who are confined to wheelchairs. When the American Association of Home Builders came up with the concept of "smart home security," they were inspired to develop a whole new generation of sensors. Despite the fact that work has been made to improve upon this concept over the years, one of the most pressing concerns regarding the home automation system has been the issue of safety. The National Fire Protection Agency of the United States of America says so. The fire departments of the United States respond to approximately 3200 gas-related residence fires every year, with a fire department responding to a fire somewhere in the country every 24 seconds. The objective of this paper is to develop and present numerous models that operate on the Internet solely through the use of IoT and other technologies. The smart home automation system described in this paper is being implemented in many cities. We employ a variety of sensors to keep our houses secure and smart as a result of its design. These include gas detection sensors, Smart thermostats and Smart garage door sensors, movement sensors, Smart thermostats and fire sensors, among others. Not only that smart sensors are also used in ICU monitoring also (Sharif, Al-Mamun, & Kabir, 2021)

III. METHODOLOGY & SYSTEM MODEL

We worked with a variety of gadgets and sensors that are commonly found in the home to create a smart home automation system. We experimented with many digital devices in order to make our homes more pleasant and safe. These gadgets included the ESP8266 (*Arduino Uno R3 Board*, n.d.), a servo motor bel(Controlling Multiple Servo Motors with Arduino, n.d.), a smoke sensor, and others. We use the ESP8266 to create an internal Wi-Fi network (*ESP8266*, n.d.), which ensures that all of the devices are connected to one another. A smart home is one that is capable of being extremely cautious in the event of an accident. Fire is a fairly regular occurrence in our homes; in order to combat this, we wanted to install some smoke sensors that would sound an alarm if a fire mishap were to occur. Any unauthorized access to our home should be prevented, which is why a password system will be implemented when someone attempts to get entry to our home. However, if the password is entered correctly, the servo motor (*Servo Motor Basics, Working Principle & Theory*, n.d.) will immediately open the door and welcome the visitor into the house. Movement of people will also be tracked, since PIR sensors will be used to detect the presence of people in our homes. This might be highly effective in providing us with greater home safety. Any important alarm will be displayed on the screen if there is a led display present (*Basic LCD Project (Arduino LCD 16x2 Display) : 3 Steps - Instructables*, n.d.). The entire system will be monitored from a central location, and all data will be saved in case it is ever needed again. In addition, we planned to trigger a mail alarm on a registered letter in the event of an accident. Also, we would like some additional capabilities in a smart home automation system that will make our lives even easier. We have the ability to manage the temperature of our air conditioners, as well as other lighting and technological gadgets, which offers us greater control over the items we use on a regular basis. Because the entire system is comprised of hardware and software, we attempted to keep the costs as low as possible, which resulted in a more effective home automation system.

IV. SENSORS COMMONLY USED IN SMART HOME

Fire/CO detection: Fire has the ability to completely demolish a large amount of property in a matter of seconds. Thousands of individuals lose everything and are forced to live on the streets year after year. If it continues to grow at its current rate, the planet will be in danger. Carbon monoxide detectors are a simple way to identify potentially hazardous places. People can be cautioned about potentially hazardous situations in this manner. These sensors contribute to the saving of lives by identifying potentially dangerous areas. However, the most intriguing aspect is that insurance companies are offering substantial discounts on all of these sensors. As a result of the use of these sensors, it is possible to preserve human lives and property from fire. Furthermore, it is one of the few significant sensors that are employed in smart houses.

Leak/moisture detection: We experience a variety of losses as a result of water leaks in the majority of cases. It has the potential to detract from the aesthetics of the home and be the victim of a variety of accidents. However, with the help of this sensor, we will be able to get rid of it. The sensor should be pre-installed in the areas where leakage is likely to occur. And, with the help of this sensor, it is possible to identify any water leaks that may exist. This sensor can identify where water is seeping and where it is not. In addition, water resistant measures can be implemented quickly. This will not detract from the aesthetics of our home, and the structure will remain secure. As a result, it can be stated that this sensor is critical in the conversion of a house into a smart home.

Window & door open and close: Sensors installed on doors and windows can detect the presence or absence of individuals. As soon as the valid person stands in front of the entrance, the door detects and opens automatically, and it closes automatically again when the person has entered. Realizing that individuals are there, the windows open and close according to the directions on the screen. If an unauthorized individual attempts to open a door or window,

the sensors will send you an email or phone call to alert you. Because of this, our home is really safe. We don't have to do any labor since these sensors take care of everything; everything is done automatically. These sensors also play an important part in the development of smart houses.

Video doorbell: With the help of a video doorbell sensor (*DIY Smart Wi-Fi Video Doorbell Using ESP32 and Camera*, n.d.), we can keep our home safe from intruders entering. With the help of this sensor, anyone who is standing outside the door can be identified and identified with the use of a mobile device. You will be able to see who is doing what inside and outside the house while you are there. And, whether we're at home or on the go, we can always keep an eye on things thanks to our smartphones. There are sophisticated sensors installed as part of this feature, which will prevent burglars from entering the residence. And, with the use of alerts, it can notify those in our immediate vicinity as well as contact us. Consequently, it can be stated that this sensor significantly increases the security of our home while also playing an important part in the development of a smart home.

Smart thermostat: The use of smart thermostats can aid in the maintenance of a comfortable home temperature. Adjusts the inside temperature in accordance with the weather outside, allowing us to live comfortably at the appropriate temperature. When the temperature drops in summer and rises in winter, it makes it more comfortable for us to live in by ensuring that the temperature balance inside the house is maintained properly. When no one is at home, the sensor can cause temperature variations to occur. It is possible to turn it off if necessary. Once again, when visitors arrive, they ensure that the proper temperature is met. If no one is at home, it can be turned off completely, which saves electricity. We have a comfortable environment because of the superb temperature adjustment provided by these sensors. We don't have to worry about these tasks because they are automated. As a result, it can be asserted that it plays an important part in the development of smart homes (*Thermistor Based Thermostat Circuit Diagram*, n.d.).

Motion sensors: A typical feature of home security systems is the use of motion sensors to detect movement. It has the ability to detect the presence of any human or animal from a 120-degree angle. It essentially detects the movement of a person or an animal from a given distance. Despite the fact that I am not at home, it allows me to perceive the sensor and activate an alarm (*Simple Security Alarm Circuit Working and Applications*, n.d.) if an intruder enters or attempts to enter the house, as well as inform me by phone or SMS. The device can be installed in a secret house or in a risky location so that when a person arrives, an alarm is activated (*Simple Security Alarm Circuit Working and Applications*, n.d.) and the appropriate notification is sent to the appropriate person. When it comes to kid safety, this sensor can be utilized to detect when youngsters cross an imaginary line that has been set by the manufacturer. It detects the presence and absence of people in a space and regulates other devices such as lights and fans, as well as playing a significant part in electricity conservation. They can be coupled to the camera so that even when we are not present, if an intruder enters the house, the sensor will detect it and activate the video camera, allowing us to catch him in the act. With the addition of a new dimension to these sensors, they may be utilized for a number of reasons to help you build a smart home from the ground up.

Smart garage door: As a result of this technologically advanced garage door, we no longer have to recall whether or not we have installed the door to our garage. With the use of sensors, we can lock our garage doors from anywhere in the world using our mobile phones. The door will be connected to Wi-Fi, allowing us to stay connected with our mobile devices from any location. It is planned to connect the door to Wi-Fi so that we can stay connected to it from anywhere in the world using a mobile device. If the door is not connected to the wife's computer, it is not feasible to monitor it from any location at all. This smart garage door makes use of technologies that we can also apply on other doors to provide the door with the highest level of security.

Intercom/hub: It is necessary to have a specific location in order to operate all of the sensors that have been installed in a smart house. The work that has been interrupted or is only half completed. Every sensor was installed with the owner's permission. It is possible to summon emergency repair services by simply pressing a button on the control panel. A convenient way to communicate from one room of the house to another is provided by this. Alternatively, it can be communicated by audio conference call or video conference call. It offers two different services. When we are out and about, it can be one of the most effective ways to communicate with those at home. This enables us to effortlessly connect with family and friends at home, even when we are away from the house. There is also the possibility of quickly learning if any type of mishap occurs at home. There are many different types of sensors available on the market (*Home Security System Market Worth $74.75 Billion by 2023*, n.d.) that play an important role in the creation of a smart home as well as playing a key role in the provision of home security (*Smart Home Market Projected to Double in 2016*, n.d.). Our house can be transformed into an ideal smart home with the help of such sensors (*Page Not Found - Ktechnics Systems*, n.d.).

V.   LIST OF SENSOR & COST

Sensor Name	Cost (Minimum)
Motion Sensor	400tk
Smoke /Gas sensor MQ-2	150tk
Flame Sensor	80tk
Water Leak Detector	2000tk
Wi-Fi Water Sensor	1800tk
SmartThings Hub	70$
OxyLED	3000tk
Home Door and Window Sensor	40$
Water Sensor	3000tk
Temperature Sensor	200tk

Light Sensor	1000tk
Proximity sensor	1200tk
IR sensors	70tk
Optical sensors	1400tk

VI. OUTCOME

First and foremost, here is a comprehensive list of all of the sensors that are used to create smart homes. It provides a thorough understanding of the function of these sensors, as well as an estimate of the cost of the sensors themselves. People can simply construct a smart house in their own homes based on their own abilities with the help of this technology.

VII. CONCLUSION & FUTURE WORK

Home, whether it is our own residence or a piece of real estate, is an important component of our lives. Recently, there has been constant technological advancement in the creation of safety systems over the course of a few years. The most reliable and efficient components are used in the construction of a smart home security system, and the overall prices of the equipment are kept to a minimum in order to improve system performance. The system installed in the home notifies the homeowner as soon as it detects any security issues by sending a mail notification to the address on file. This is the primary purpose of this paper: to create an environment in which consumers feel safe and unconcerned even while the homeowner is away from home. The structure that has been built can be employed in industrial applications such as offices, banks (*Dutch-Bangla Bank*, n.d.), and warehouses. In comparison to other smart home security systems now available on the market, the overall costs of the developed smart home security system are quite inexpensive. After closely examining its operation, it can be concluded that the equipment has been meticulously built and is extremely efficient and dependable. It is our intention to make the reader of this article aware of the fact that our country need a security system that is both inexpensive and efficient, and that it is therefore critical for our country to progress in this area. Almost all scientific advancements and cutting-edge technologies have both positive and negative aspects. This does not imply that technological advancements should be discouraged. Such labor motivates us to achieve better for our nation. Our country has benefited greatly from smart technology. We should make every effort to avoid negative repercussions and to exploit them to our advantage.

Throughout the process of our research, we discovered some restrictions. Because our paper is reliant on the internet, if the internet connection is interrupted, the security system will also be interrupted. Electricity is used to power the entire apparatus. When a power outage happens throughout the country, the system operates only on the backup batteries. If the backup batteries fail, the door lock system will be unable to operate, and the other system components will be rendered inoperable as a result. We reduced the amount of circuitry we used in order to keep the price as low as possible. Users must incur additional costs in order to benefit from additional services. The more advanced the system is, the more expensive it will be in terms of cost.

The future of our paper lies in the introduction of promising techniques, such as fingerprint scanning, retinal scanning, and iris mapping, among others. It is possible to implement a better flame and smoke sensor system with better sensors when the range and precision are increased. This will improve the sensing efficiency and accuracy while also reducing the number of sensors required for the implementation over broad regions or places. A solar power(Gabriele et al., 2015) system can make this system both affordable and long-lasting by utilizing solar energy (Boynuegri et al., 2013). The system can then be powered entirely by solar energy(Gabriele et al., 2015). As a developing country, Bangladesh is developing rapidly due to the increase in industry and technology. However, the country has been facing an energy crisis for many years to meet growing demand. Gradually, the gap between energy supply and demand is getting bigger and bigger. An effective way to close the gap is to conduct regular energy audits of all departments to help identify losses and wastes and provide room for improving utilization (Sharif, Al-Mamun, Kabir, et

al., 2021). Moreover, thin film solar such as CZTS & Perovskite both are used along hybrid solar-wind system are used to reduce energy consumption (Sharif et al., 2020; Sharif & al Mamun, 2021; G. Sharif Ullah Al-Mamun et al., 2020; G. M. Sharif Ullah Al-Mamun et al., 2019).

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