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An Experimental Study for Exploration-oriented Behavior in Maze-solving using Reinforcement Learning based on Communication Protocol

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ABSTRACT

In this study, the reinforcement learning agent under the situation of communicable as multi-agent system will be improved efficiency. In reinforcement learning, this method will be supposed that agent is able to observe the environment, completely. However, there is a limit on the information of the sensors. Moreover, it is hard to learn the reinforcement learning agent in the actual environment cause of some noise of actual environment or source device. In addition, a time per a episode will enlarge because an agent will be explored in a given area.

In this study, the proposed method has been using two type agents that communicate as information exchange on the location to settle this problem, moreover, the noise will be mixed with knowledge space in the situation of the knowledge sharing. In addition, sometimes the any information won't be transmitted in the situation of knowledge sharing. Thus, the self-decision mechanism will be installed. From this viewpoint, in this study aims to improve maze-solving technique, efficiency by which to the multi-agent reinforcement learning's agents under the situation. As a result, the proposed method has been confirmed that is provided suitable solution for an approach to the goal for the agents.

KEYWORDS

Mobile Robot, Exploration-exploitation Ratio, Reinforcement Learning, Maze Problem, Route Planning.

1   INTRODUCTION

Over the years, many studies have been conducted with the objective of facilitating the working of robots in dynamic environments [1, 2, 3]. Various robots have been developed to assist humans in workspaces, such as a house or factory [4]. In general, robots are required to work effectively and safely in a dynamic environment to achieve their tasks. However, it is not easy to make a robot behave like a human in dynamic environments [5, 6]. When they are working in a certain environment, humans select an appropriate course of action through subconsciously predicting all the changes in the environment and their next state. However, these situations and course of actions will be exploded if a designer will be programming or designing. For achievement these problems, in recent years, various machine learning methods have been suggested. In reinforcement learning, it attracts attention as the technique that often use in the actual robot [7, 8, 9, 10, 11]. However, reinforcement learning has some problems. In one of the problems, a robot does not cope with changing purpose in reinforcement learning. Reinforcement learning has been demanded to

achieve various purposes, because that the request to robot is diversifying and to achieve various purposes in robot have been wanting, as mentioned above. Therefore, it is important to solve this problem.

Until now, an information exchange (in this paper, this process called "communication") in multi-agent reinforcement learning often hasn't been adjusted dynamically or timely [12, 13]. However, this communication will be an index of performance in the learning. Communication and autonomously adjustment an exploration-exploitation ratio will be enabled if this method will be proposed. For this achievement, in this study, agents learn using information from the communication for a task as known as exploration-exploitation ratio of another agent will be suggested. Unfortunately, it will be occurred that the random noise will be mixed up with an actual Q-space or disconnected using the ordinary wireless transmission line. The authors have been studying about the paddy-weeding robot up now on.

The concept of the weeding robot system
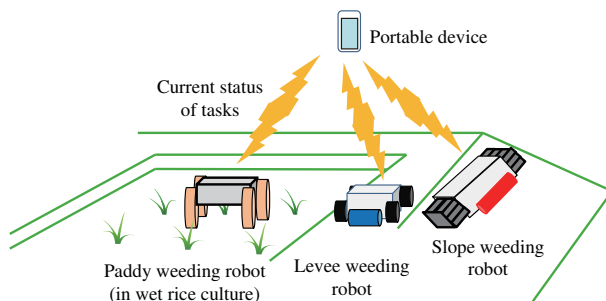
Figure 1. A Covered Area the Weeding Robot Systems Followed.

will be developed is shown in fig. 1. Examples of these element technologies include a traveling section having fine running performance suitable for various working environments, a weeding section for removing weeds, a sensor and control system for autonomous working, and an ICT technology for providing information to the labor in the remote area. Even when it is said to be a weeding robot in general the range is extensive and complicated; working environments according to purpose are also diverse, such as weeding on the levee or wet rice culture, grass cutting on the slope of the inter-

mountain areas.

In order to solve the problems mentioned above, the crawler-type prototyped robot in the study. This robot is equipped with a GPS module, an ultrasonic sensor, magnetic compass module with gyroscope and accelerometer, and a camera module. If these sensor information will sharing with each robot, it will be expected that to work cooperatively and efficiently in the workspace. At the same time, from this plan, it will be expected that the load balancing and the real-time performance will be improved. Thus, in this study, the communication system has been constructed based on simulation.

In this study, agents define an "aggressiveness." An exploration-exploitation ratio has been included in reinforcement learning. An agent's performance that task accomplishment or explore the purpose environment will be determined by this ratio. In detail, the aggressiveness will be depended by an ability of communication. The aggressiveness will decrease when the communication has been accomplished, and inversely, the aggressiveness will increase when the communication has been failed. In addition, the mixed noise will be considered during communication. From this proposed method, the communication will be adjusted from other agents' behavior, dynamically.

In this paper, we propose the action decision and communication method based on other agent. Moreover, in this study, we discuss effectiveness using a maze problem as an example. As a result, we confirmed that the proposed method is well influenced from other agent's behavior.

This paper is organized as follows: In section 2, we explain the how to obtain and adjustment dynamically the exploration-exploitation ratio from other agents' behavior. In Section 3, we explain about the setting for the experiment. Finally, in Section 4, we present the conclusions of this study.

2 A CONCEPT OF ACTION DECISION BASED ON OTHER AGENT'S BEHAVIOR

Former works [14, 15] have been focused only on knowledge sharing. However, these methods had not been focused on ability of knowledge sharing or motivation-adjustment based on a wireless communication environment. In fact, often it has been the receiving status of the radio waves is adverse. In case when communication using wireless transmission, it will be considered carefully when occurred that communication fault, or mixing noise with communication payload.

The figure 2 is the outline of the proposed
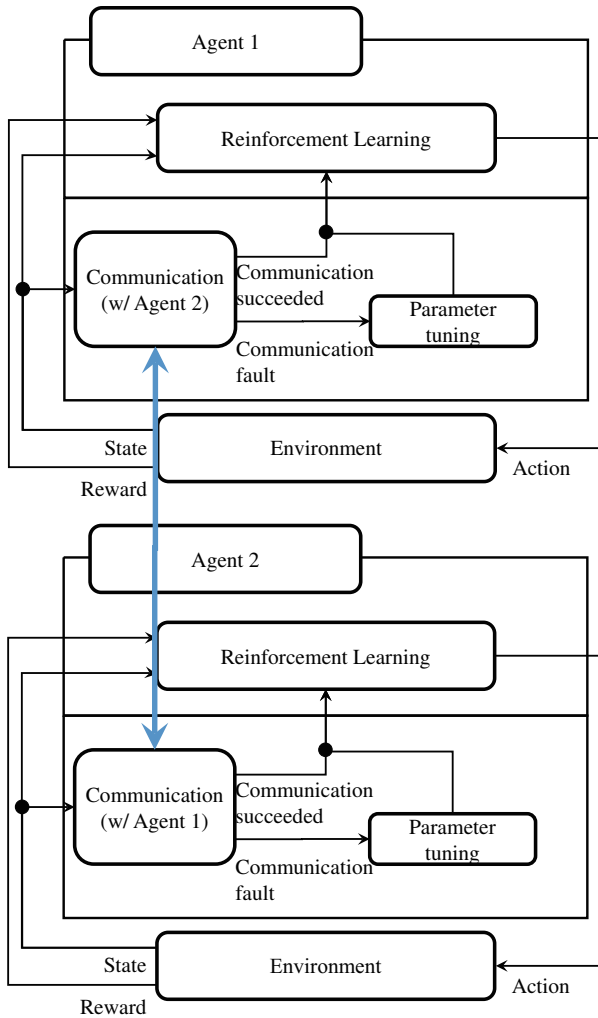
Figure 2. An Outline of the Proposed System.

system. In this method contains two parts; Communication part (the part trying the connect to another agent), and Parameter tuning

part (the part calculating the aggressive rate of agent when the communication fault). At this time, the agent operating in the proposed system also has the influence of other agents in addition to the state and reward of the environment. In general, an agent requests resend for information to any other agent when some communication fault has been occurred. From this viewpoint, the agent should decide a resend request to another agent when complete information as knowledge will be obtained without any error or noise. However, it will be occurred that the packet-loss or the lower Received Signal Strength Indicator. In this case, two type way of action decision will be proposed:

(1) When the communication fault occurred, increase the aggressiveness.

(2) When the communication succeeds, compare the knowledge current received with the knowledge that just before the communication.

In this paper, above two way of action decision will be stated.

As mentioned before, in this study, agents define an "aggressiveness." An exploration-exploitation ratio has been included in reinforcement learning. An agent's performance that task accomplishment or explore the purpose environment will be determined by this rate. In detail, the aggressiveness will be depended by an ability of communication. The aggressiveness will decrease when the communication has been accomplished, and inversely, The aggressiveness will increase when the communication has been failed. Hence, the aggressiveness of this agent by setting the number of communication faults N_{fault}, and number of communication trials N_{all} during the task progress can be expressed as a mathematically model, will be as follows:

$$\varepsilon = \begin{cases} 0.5 & \text{if } N_{\text{fault}} = 0 \text{ and } N_{\text{all}} = 0 \\ \dfrac{N_{\text{fault}}}{N_{\text{all}}} & \text{otherwise} \end{cases} . \quad (1)$$

In this paper, we express this as the aggressiveness by the agent. Now, in this case, the aggressiveness may be indefinite in initial state as

$N_{\text{all}} = 0$, is natural to regard the aggressiveness as 0.5 regardless of the state of the agent. From this viewpoint, an agent will be performing that task accomplishment when the communication succeeded for task achievement quickly. On the other hands, an agent will be performing that explore the purpose environment when the communication fault to support another agent's task achievement.

3 VERIFICATION EXPERIMENT – COMPUTATIONAL SIMULATION USING THE PROPOSED METHOD

3.1 Outline of the Experiment

We verify the effectiveness of the proposed method up to the previous section by computer simulation. The effectiveness is evaluated by comparing the difference of the convergence speed of the learning of the proposed reinforcement learning with the proposed method. At this time, the ordinary reinforcement learning method is to learn the route that reaches the goal while avoiding walls through trial and error, and the reinforcement learning to which the proposed method is applied. A behavior will be selected according to the behavior facing. In addition, in this experiment, an incomplete perception agent will be applied the proposed method, not only a completely perception agent.
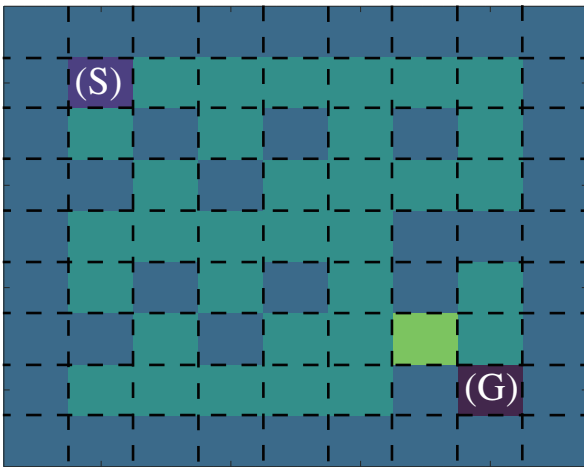
Figure 3. An Experimental Environment (Grid Maze).

Also, consider the maze environment with walls consisting of a grid of 9×9 shown in fig.

3 as the experimental environment. Moreover, the two-types agents are implemented the proposed method will be affected by one agent as a communicate target, during task execution.

In figure 3, the water blue-colored mass is the wall. The two agents are complete or incomplete perception and can move up, down, left and right of the grid. An agent can get a reward 0 when agent reaches the goal point (G), and it can get a reward -5 when the agent reaches the wall.

Table 1. Experimental parameters for Agents.

Agent-1	Agent-2	Agent-3	Property
0	0	0	Initial value of Q values
0.1	0.1	0.1	Learning rate α
0.95	0.95	0.95	Discount value γ
0.5	Eq.(1)	Eq.(1)	Exploration rate ε

3.2 Condition of Simulation

In this experiment, we mainly deal with episodic tasks: Agent-1 is a complete perception agent that operates with ordinary reinforcement learning, Agent-2 is a complete perception agent that combines the proposed method and reinforcement learning. In contrast, Agent-3 is an incomplete perception agent that combines the proposed method and reinforcement learning. Agent-1 won't be affected by learning progress of Agent-2 and Agent-3. Inversely, Agent-2 and Agent-3 will be affected by learning and behavior Agent-1 through the communication.

When each agent reaches the goal point (G) from the start point (S), the reward is obtained and the process reverts to the start (S). Treat this as one episode In this experiment we will do 300 episodes. Setting of experimental parameters is as indicated in the following table 1.

3.3 Discussion on Simulated Results

In figure 8, ε is 0.5 at the start of the action and chooses the exploratory behavior. Withal, as learning progresses, ε converges to 0.5 as
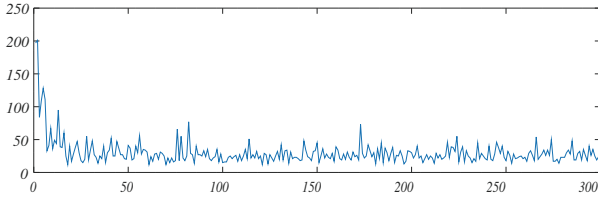
Figure 4. Number of Action per Episodes of Agent-1.
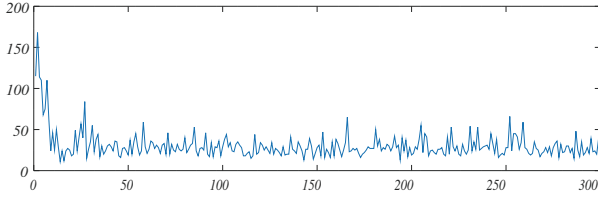
Figure 5. Number of Action per Episodes of Agent-2.
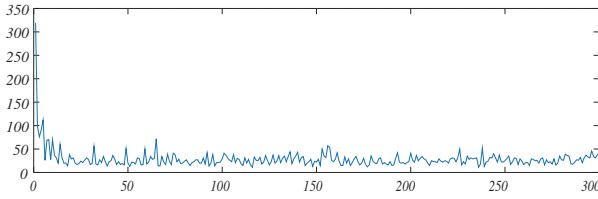
Figure 6. Number of Action per Episodes of Agent-3.
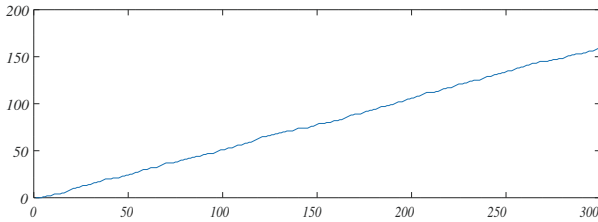
Figure 7. Transition of Number of Communication Disconnection with Agent-1 and Agent-2.
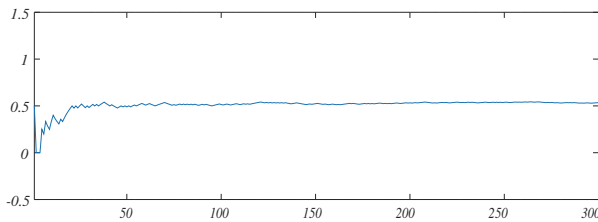
Figure 8. Transition of Exploration-exploitation Ratio ε of Agent-2.
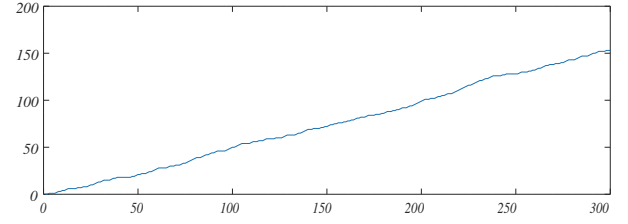
Figure 9. Transition of Number of Communication Disconnection with Agent-1 and Agent-3.
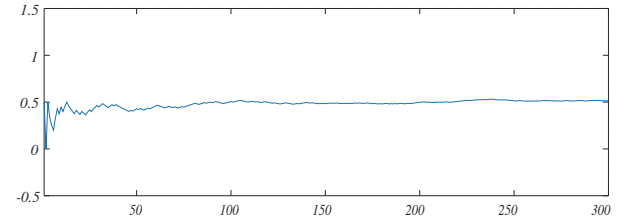
Figure 10. Transition of Exploration-exploitation Ratio ε of Agent-3.

follows a number of Agent-1's goal arrival during the episodes are proceeding. Moreover, in the following episode, ε becomes also 0.5 the other hands, ε had been holding when Agent-1 has faced on Agent-2 was confirmed. Conventions are the same as in Fig. 10, Agent-3's ε is 0.5 at the start of the action and chooses the exploratory behavior as similar as Agent-2. In addition, Agent-3's ε converges to 0.5 as Agent-1's goal number increases, next episode. Moreover, in the following episode, also ε becomes 0.5 was confirmed. In parallel, the numbers of action selection per each episode of Agent-3 are lower than Agent-2 in spite of incomplete perception agent. Considering the result, it will be concluded that the comunnication method influence the efficent exploitation action to Agent-3.

Moreover, during the episode proceeds, ε becomes 0.5 the other hands, ε had been decreasing when Agent-2 and Agent-3 have connected on Agent-1 was confirmed (Figs. 7 through 10). We will be considered that the decrease resulted from an action strategy of Agent-1. From this solution, it could experimentally confirm the fact that actioned will be become while watching the progress of the aggressiveness. Consequently, the action was realized by searching for an action that finds the optimal solution of the given task (along with

it) only when the agent to find the optimal solution of the task that will be confirmed.

4 CONCLUSION

In this paper, a method to dynamically adjust the action-decision strategy based on communication with each other agents', has been suggested. In this method, the valuation of the agent's behavior results is ability of communication. Moreover, in the proposed method, the aggressiveness will be depended by an ability of communication. The aggressiveness will decrease when the communication has been accomplished, hence, this index has been defined. Farther, these parameters have been affected the exploration ratio as ε. From this method, the simulation results showed the proposed method has been acquired actions to make the goal more efficiently than conventional method. From these results, the proposed method has been confirmed to efficiently execute the task, while adjusting by communication. Therefore, we resolve that the usefulness of the proposed method has been confirmed.

Now, let's consider the knowledge sharing as sharing Q-space, again. It will be needed for efficiency when multi-agent robots will search the given purpose environment. If the given task aims that search a goal point, knowledge sharing and separate the explore area per agent are important factors for task achieve faster. As a future work, to achieve this issue, the method to compare the Q-space will be concentrated on.

As mentioned before, the knowledge will be an index of performance in the learning. Thus, agents learn using information from the knowledge for a task as known as Q-space of another agent will be suggested. The Q-space will increase each Q-value (that includes all of the state and the action) during learning per episode. Finally, an agent finds a way to shortest route for a goal based on high-frequently Q-value pass. In this case, a knowledge sharing method that comparing Q-space will be effectual to explore the given environment with each agent.

On the other hands, it will be occurred that the random noise will be shuffled up with actual Q-space if the sharing process using the ordinary wireless transmission line. From now on, it will be suggested that agents learn using another Q-space which includes random noise from the evaluation of achievement for task of another agent will be considered. In addition, the mixed noise will be studied during the knowledge sharing. To achieve this, a kernel trick for comparing the knowledge will be riveted on.

As the future study, implementing the proposed method to the actual weeding robots will be planned as shown in fig. 11. At the same time, it is necessary to investigate for effectiveness the algorithms to introduce multiple robots with different body structures or different roll with individual roles into the workspace, to work cooperatively and efficiently. Moreover, up until now the communication system for position information using LoRa private, has been prototyped (in fig. 12). From now on, also it is necessary to investigate for effectiveness the prototype system to introduce multiple robots, to work cooperatively and efficiently in the real field.

Figure 11. A Paddy-weeding Robot.

Figure 12. LoRa Shield for Raspberry Pi.

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A REVIEW ADVANCEMENT OF SECURITY ALARM SYSTEM USING INTERNET OF THINGS (IoT)

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ABSTRACT

The objective of today's pervasive computing is implanting a wireless and computational transmission unit into every physical item that individuals need to intermingle with starting from house appliances, refrigerators to a regular chair. This idea of universal transmission also popularly knowns as (IoT) Internet of Things, can leads to the development of innovative origination of the Internet. Internet of things (IoT) environment has made one-step further movement in the way of pervasive connectivity. The application of IoT in organizations, industries, homes, and society has transformed the whole outlook on foreseeing, monitoring, and different phenomena and processes against intrusion or abduction. However, this constant advancement of the internet of things (IoT) usefulness is extremely cherishing; the seeing of its security disputes is likewise significant mainly in the state of pervasive accessibility of the internet The rate of theft and abduction in some parts of the world is increasing by the day; this imbibes fears that become a threat to the peace and economic development of any society nowadays. It is paramount to find viable technologies that will secure the lives of humans as countermeasures to tackle this kind of problem. With the help of the latest development of technology, it is possible to secure people's lives, industries, schools, organizations, and homes using an alarm security system that will monitor, guide and protect against burglar and abductors and make life easier using internet of things (IoT). This paper will review related works on the security alarm system from its origin, its advancement in technology using internet of things (IoT); challenges faced using the internet in the security alarm system and its impact of installing the security alarm systems.

KEYWORDS: Abduction, Advancement in Technology, Internet of Things (IoT), Security and Theft.

1. INTRODUCTION

The most basic definition of any security system is generated from its name; it is literally a means or method by which something is secured through a system of interworking components and devices. In this instance, we are talking about home security systems, which are networks of integrated electronic devices working together with a central control panel to protect against burglars and other potential home intruders figure one below shows a model of an advanced security alarm system and its various components it consists of [1].

Figure 1: A model of an advanced security alarm system.

Today, our home monitoring and alarm security systems have become common. One of the motives for this is the increase in crimes, abduction, and robbery in the world today. Many of our homes, industries, schools, and organizations today are invade mostly by force either through a criminal entry or through breaching a window, entering through a cutting celling or even entering through a closed door or sometimes even an open window [2]. Circumstance has shown that most criminals are usually cut off by the help of the simple existence of an alarm security system in our homes hospitals, schools, organization, and industries. Criminals usually invade far more defenseless constructions compared to those guarded by security alarm systems. The improvement of the security alarm systems started with the creation of man. To give threatening information, human being

implements a form of a signal, shout, and sound. It was then replaced with the help of the clapping of hands and with the instilling of signals to notify society or to blowout a certain message during the early periods of some African society [3]. All these methods of warning are fundamental, unreliable and unsystematic. With the help of advancement in technology today, these undeveloped methods of producing security alarm systems were changed by programmed security alarm systems in the late eighteenth period. These types of electronic security alarm systems usually work without the aid of any human being energy. When the modern security alarm system senses a positive signal which may be a sign of intrusion or breakage, it normally gives a warning of a very high sound or sends an alert to the owner subject to the type of security design [4]. The earliest electronic fire, security alarm system was developed by a man named William .F. Channing. Late on an electrical electronics engineer, Mr. Moses G. Farmer invented the construction. This alarm system uses automatic indicator boxes to label the position of the outbreak fire and was first lunch in Boston, United States of America. The development of this alarm system by Dr. William was then followed by the improvement of various stylish and difficult fire and intruder security alarm system technology that is so many to deliberate [5]. The most significant among these security system technologies is the use of remote signaling thief security alarm. This type of security alarm system was design in the early 1970s. This administers a fast inventive reaction to alarm calls. However, organizations and industries are based on the supply of security service apparatus that usually come in dissimilar designs to keep burgles and thugs away from the environment that are not built for them. Today, we have an innovative group of electronic security alarm system with complexity at various levels [6]. With the latest flow in crime rates in the world, it has become very essential to safeguard our buildings and our property with the aid of sophisticated stages of various advanced security alarm devices. The prices of such kinds of security alarm devices depend on the apparatus technology and solicitation desires. These alarm security system devices are characterized by present electronic security alarm systems. Some of nowadays-modern security alarm systems are housebreaker alarms, threat alarms, industrial alarms, speed limit alarms, and anti-theft vehicle alarms [7]. The intruder alarm security is initiate by a cycle, from a comprehensive automated circuit loop that is close with an alarm at its output, or an indication to inform the owner of danger. They are a central control box that normally observer different gesture indicators and the perimeter protections that give an alarm or notify the owner when any of this sensor is a trigger [8]. Some of the intruder's security alarms system normally functions delicately on the conception of a magnetic contact and others. For those types of security systems working with the sensors, these devices are usually positioned at any entering of the industries, organizations, and building. In this case, the sensor will activate an alarm if the device gets a signal above its set inception [9]. In the case of motion detection, the ultrasonic sensor is normally used; the point indicator can be used in the concession of a criminal alarm, theft or illegal individuals at certain points such as doors or windows [10]. For instance, when a precise environment needs to be look over the awareness of the burglar in the protected environment is used, which is executed with the help of ultrasonic sensors and is normally fixed at an appropriate location. Presently, closed-circuit television (CCTV) shown in figure two below, has been combined in the thief security alarms system to recognize the existence of illegal personnel.

Figure 2: A model of closed-Circuit television (CCTV)

The output of the intruder alarm system can differ from grief sign or loud bell cautionary to automatic telephone buttons and flashing outdoors rays [11]. It accomplishes the warning purpose possible of informing neighbors of an illegal individual and at the same time, it will function as a signal to the police. Automated dialers linked to the burglar alarms are set to call the police officials and to play a pre-recorded report notifying the police personal that the organization, industries or house has been break into [12]. With the aid of advances in technological and scientific improvements, it has made significant advancements in the technology of the security alarm devices [13]. In this research, advances in security alarm system technologies using different types of sensors that are used in the security system and advancing the security system-using the internet of things (IoT) against abduction or intrusion are review considering an intruder alarm. A security alarm system has been a great concern in the world nowadays, considering the surge in burglaries in different parts of the world today and the rise in abduction, everyone needs to take protective actions to avoid an illegal entering into their industries, organizations or homes [14]. The point that security alarm system exists in our environment or homes is often a hindrance to

frighten a burglar before trying to force an entry, making the possessions of it in our home or environments, will make you feel safe and increase peace of mind to the users [15]. These devices function as inputs that trigger the security alarm. Some of the security alarm sensor technologies that have been established over the centuries are (1) Microwave sensors: the microwave sensor, this is an electronic device that perceives signs and is used to control luminaires. The microwaves function differently from passive infrared sensors, by extruding microwaves, which bounce off surfaces and return to a sensor within the indicator. The microwave sensor can easily perceive any activities within its range and do all this in less than a microsecond. The microwave sensors can easily penetrate the hole and walls. Because of its ability, it can cover a very larger area of commercial properties, industries, organization and homes that needed to be secure. Because its properties are required to make use of it especially for, those who want to secure a very large environment. The microwave sensors are mostly less expensive to buy. The microwave sensor is motion-sensing devices that normally flow in a definite area or in the area within the electronic field. Movement in or out of the area that needs to be secure quickens the speed and triggers the alarming figure three below shows the image of the microwave sensor.

Figure 3: Microwave sensor

(2) Vibration Sensors: Vibration sensors are sensors that are used for displaying, measuring, and evaluating linear velocity, displacement, acceleration, and proximity. Vibration sensors

are usually fixed on ceilings, floors, and walls to sense mechanical vibrations produced by drilling, chopping, or because of any physical attack figure, four below shows the image of the vibration sensor.

Figure 4: Vibration sensor

(3) Photo electrical ray sensor: The photoelectric sensor usually discharges a light ray infrared or visible from its light-emitting element. A reflective-type photoelectric sensor is usually used to notice the light ray reflected from a certain target. While a thru beam, type of sensor that is to measure the changes in the light magnitude caused by the target passing through the optical axis. The photoelectric sensors usually transfer infrared beam to the receiver, usually in the form of a light ray, in a remote area, thus forming an electronic fence. These types of sensors are usually used to close openings, such as corridor paths or doorways, which are broken open. Whenever the light ray is disturbed or interfered, it will automatically produce an alarm signal figure five below shows the image of the photoelectric sensor.

Figure 5: Photoelectric Sensor

(4) Electric field sensors: The electric field sensor is a micro-electronic based device that can normally notice the existence of both stationary and moving objects through solid materials. Its facility to function through any non-conductive material permits complete invisibility. The electric field sensor function by noticing any small changes in an ultra-low-power electromagnetic field produced between two remotely positioned antenna electrodes. These sensors normally create an electrostatic field between and round a series of conductors and an electrical ground. Is for identifying up and down or degradation in the field. The sensor can be activated by anybody touching or approaching the sensor figure, six below shows the image of the electric field sensor.

Figure 6: Electric Field Sensor

(5) Sound sensors: The Sound Sensor is usually a minor board that is merging with a microphone and some processing circuitry. It produces not merely an audio output, but also a binary sign of the presence of sound, and an analog exemplification of its amplitude. These sensors usually react to the sound generated by intruders entering through the secure environments figure seven below shows the image of the sound sensor.

Figure 7: Sound Sensor

(6) Capacitance sensors: Capacitive sensors can normally be used to identify metallic substances as well as close all additional tools like liquid and solid substances. The capacitive sensors are frequently used as a limit switch, for flow control, object detection and for counting purposes. The capacitive sensors notice variations in the electric field. Whenever an intruder gets closer to it or by direct contact with the sensor wire, it brings about changes in the capacitance of the field, which can either be a higher or lower level than the verge signal level, this will automatically generate a signal figure-eight below shows the capacitive sensor.

Figure 8: Capacitive Sensor

Internet of Things this is the network of linked physical items that can convey and transfer information between themselves without the desire of any human being involvement. It has been officially well defined as an "Infrastructure of Information [16] Society", this is because the internet of things permits us to gather data from different types of avenues such as animals, humans, kitchen appliances and vehicles. Therefore, any item in this real-world which is been administer with an internet protocol (IP) address to allow information communication over a certain network can be made part of the internet of things system by embedding them with automated hardware like a sensor, software, and networking gear. Internet of things is distinct from the Internet as in a way it transforms Internet connectedness by permissive everyday items that use embedded circuits to communicate and relate with each other applying the current Internet infrastructure [17]. The internet of things framework has assisted in administer actual period data analysis and gathering using correct sensors and seamless connectedness, which may aid in making effective choices. With the initiation of the internet of things, both consumers and manufacturers have profited. The producers have obtained awareness on how their commodities are used and how they execute out in the actual world and upsurge their incomes by administering value extra services that elongate and enhances the lifespan of their commodities. The consumers usually have the capacity to control and assimilate more than one gadget for a more modified and improved consumer experience [18]. The word (IoT) meaning

"Internet of Things" and was first originated by a businessperson name Kevin Ashton, he is one of the originators of the Auto-ID Center at MIT. The term internet of things (IoT) and its idea can be drawn back to the year 1985 when Peter .T. Lewis talked about the idea during a speech he is delivering at Federal Communications Commission (FCC). Ever since the choice of using the internet of things (IoT) has developed enormously as presently it comprises more than 12 billion linked gadgets and according to professionals, it will continuously be increasing up to 50 billion by properly the end of the year 2020 [19]. Ashton Kevin was among part of the group that learned how you are going to link items to the internet through an (RFID tag) the RFID is the Radio Frequency Identification Tag; this is an electronic tag that exchanges information with a radio frequency identification tag (RFID) reader through radio waves. Most of the radio frequency identification tags are usually made up of two main parts [20]. The first part of the radio frequency identification tag is the antenna, which usually receives the radio frequency (RF) waves. While the other part of the radio frequency identification tag is, an integrated circuit (IC), which is responsible for the storing and processing of the information to be used, as well as demodulating and modulating the signal of the radio waves sent and received by the antenna. Ashton Kevin was the first individual that makes use of the phrase Internet of Thing (IoT) in the year 1999 presentation and it was fixed around ever since [21]. Kevin Ashton may have been the first person to make use of the term (IoT) Internet of Things, but the idea of linking of devices mainly linked machines has been on existence for a very long period. For instance, the machines we know have been communicating with each other ever since the initial electronic telegraphs were established in the late 1830s. Additional technologies that were fed into the internet of things (IoT) were the radio voice transmissions, wireless (Wi-Fi) technologies and the supervisory control and data acquisition (SCADA) software. Then in the year 1982, an improved Coke device at Carnegie Mellon University became the earliest linked smart machine. Using the university's internet students might likely find out, which drinks were provided, and whether the drinks were cold for consumption [22]. Currently, we are now existing in a world where there are lots of internet of things (IoT) linked gadgets than people. This internet of things (IoT) linked machines and gadget that ranges from wearables gadget like smartwatches to radio frequency identification (RFID) inventory-tracing chips. The Internet of things (IoT) linked gadgets that communicate through networks or cloud-based podiums linked to the Internet of Things (IoT). The real-time vision gathered on this internet of things (IoT) is that it will collect information fuel digital revolution. The Internet of Things assures numerous progressive changes such as safety and health, operations, business, global environmental and humanitarian issues and industrial performance. In this research, we are concerned with the importance of the internet of things (IoT) in the security system. The internet of things in the security system, this is the technology part concerned with the protection of linked devices and networks in the internet of things (IoT). The internet of things (IoT) comprises adding internet connectivity to a system of interconnected figuring gadgets, digital and mechanical machines, items, people or animals. Each "object" is to provide an exceptional identifier and the capacity to immediately broadcast information above a certain network. Being linked over the (IoT) Internet of Things to receive, send and frequently perform on information outcomes in many of the smart internets of things (IoT) things that we normally use to build a more secure, suitable, creative and smart world. Previously, (IoT) Internet of Things abilities performs an important role in the security alarm system, businesses, and digital revolution efforts [23]. In the process, we can mix internet of things (IoT) information with advanced data and leading to the (AI) Artificial Intelligence, the Artificial intelligence can increase the rate of the internet of things (IoT) by making use of all the information from good akin gadget to encourage learning and shared brainpower. Some of the essential methods that artificial intelligent (AI) use are deep learning, machine learning, and natural language processing and computer idea [24]. The capabilities seem that the (IoT) Internet of things security has become the topic of research after a sum of unusual cases where a simple internet of things mechanism used to penetrate and raid the largest network. Wi-Fi

internet connectivity and communication technologies have upgraded, so approximately every type of electronic machinery can deliver Wi-Fi information connectivity. This normally allows internet of things (IoT) sensors, implanted in (IoT) Internet of Things linked gadgets and apparatuses, to rapidly receive and send internet of things (IoT) information over a certain network [25].

2. LITERATURE REVIEW

Designing and Implementation of Security alarm system for organizations, industries, and houses based on Global System for Mobile Communications (GSM) technology was review by Govinda et al. (2014) that administer double ways to implementing security alarm system-using internet of things. Firstly is by the use of web cameras shown in figure 9, in a case when there is any motion sensed by the camera, it will sound an alarm and sends a message to the industries, organizations, or homeowners that they are an intrusion. This technique of identifying intrusion against burglary or abduction is reasonably good, although costly as a result of the price of the cameras used in the development of the security system. The camera that is going to be used in the security system needs to be of great value which means it has to have a very wide range and the image quality should be good enough to identify. likewise, if you going to work with a moving camera such as dome cameras shown in figure 10, they are normally expensive more than the ones that are fixed in one place. Short message service (SMS) based system using Global System for Mobile Communications (GSM) was suggested by Daniel and Karri in the year 2005, they suggest to use internet facilities to deliver an alert or messages to the place an intrusion took place rather than the ordinary short message service (SMS). Arvind and Jayashri 2013 have carried out a fingertip or fingerprint-based verification system to unlock a certain closed place or door. This type of security system aids users to unlock a certain place because they are the ones whose fingerprint is register to the system so if you put the unregistered fingertip it will not unlock the place or anything the finger is registered to. This type of security system is connected with some more alarm security protection features this includes fire accidents and gas leakage sensors

or detection devices. Though a great system, fingertip devices are complex and expensive as they want amplified sensor resolution to join into the internet of things system. Some professionals likewise argue that merely depending on a fingertip sensor is not wise because it is quite simple to put someone fingertip on something and reproduce it, that is why it is consistently considered to make use of fingertip scanners in a two ways authentication systems whereby an added layer of security system is made in the form of passcode, PIN, or voice recognition. Some researchers suggested an idea of a powerful internet of things security system whenever a defect in one of the components used in the security system will not result in the failing of the whole security system. The knowledge of making use of numerous gadgets which may not be directly or may be suitable with one another, however, it can be made to work in such a way that they can interchange a present item of the security system in case they are a failure. In a lineup with this, the prototypical has the capacity to use connection among several appliances, which may result in conserving energy, therefore, making the prototypical more effective. An illustration administers of this said prototypical will use a temperature sensor, Wi-Fi component and an entrance sensor to change a defective came. Light-dependent resistor (LDR) and Laser rays sensor are also used to identify an invasion using the intruder's movement were suggested in the year 2016. The method the system will work is that a light ray is face towards the light-dependent resistor (LDR) sensor and if they are an interruption between the light ray and the light-dependent resistor (LDR), the alarm linked to the sensor start alarming and sends a short message service (SMS) to the house owner or place where the intrusion takes place. This type of system will assist in solving the problems of securing the spaces, which may be out of range from your immovable cameras, but may face the same problems, which is faced with systems involving of Global System for Mobile Communications (GSM) components to send a short message service, which is that the transmission of the message is reliant on network coverage. Likewise, due to the condition of the light rays, which is a straight light beam, it can be avoided by the intruders who knew about the

security system and will be capable of dodging the light beams, rendering the whole security system useless. An innovative method of implementing and design an electronic lock security system using the internet of things technology and Morse code. The authors said that this is a unique awareness, which has never been done previously and is going to the first of it's kind "optical Morse code-based electronic locking system". This type of system makes uses Light-emitting diodes (LED) as an encipher intermediate to send signals. To make it more available to the overall community, the light-emitting diode (LED) in our mobile phones has been made use of. On the side of the receiver a photosensitive resistor as well as a microcontroller such as an Arduino processor, which normally has the capacity to crack the photosensitive signal after collecting it from the light-emitting diode (LED). Upon untangling this signal it can then transfer the present situation of this lock to a cloud system this will be going to be from where these owners of the house, organizations or industries can be monitoring the whole security system. This author has made an experiment on the system in real-life time and it has shown to perform underneath various brightness surroundings with all the features functioning, as they are designed to operate. These authors said the system is user-friendly and it has an easy user interface when making use of it. The internet of the things security system (IoT) developed in this research here operate very well, and it can be made use by everybody and is as well suitable to make use of due to the use of mobile phones as a light-emitting diode (LED), which likewise makes it a costly option. A researcher by name Anitha et al in the year 2016 suggested a security alarm system using artificial intelligence and suggested a prototypical for cybersecurity systems.

Figure 9: Web camera

Figure 10: dome (moving) camera

In this, we have seen how essential the home automation system is very important. How its main uses range from expanded relieve and larger security and safeness, and to additional reasonable usage of other resources and energy, granting major savings. The security alarm system likewise offers a great means for supporting and helping different needs of folks that have disabilities precisely old age people or individuals with a certain illness that will not allow them to be moving around either in offices, organizations or homes. The user of the home automation and its application area is very significant and will keep on steadily upsurge

even in the future [26]. The security alarm system or home automation is also known as the automation of the placed is installed or household activity. The home automation or security system usually explains a house or an area that is a link with technology and services through networking to watch over the area needed to be secured and increase the eminence of living of people. The security alarm system or home automation comprises centralized control of lighting, appliances, temperature, and other systems, to provide better relaxation, ease, security, and efficiency.

3. Challenges faced when making use of the internet of things (IoT) in the security alarm system and how to secure your system against criminals attacks

Our linked gadgets are information collectors. Our private data stored and collected with such gadgets such as our location, names, health data, may help culprit in pilfering our identification.

The Internet of Things (IoT) is now a developing drift, with a flow of innovative commodities hitting the market today. However, here is the problem: Whenever you are linking to everything, there are more ways to access your information. This can properly make you an eye-catching target for those criminals or individuals who want to make an income of your own information. Each linked gadgets you have can add additional privacy concerns, specifically since most of them are a link to your smartphone. Here is how it is working. In case you want to checkup the closed-circuit television cameras at your industries, organization or homes, unlock or lock a certain door, regulate temperature or lighting, pre-heat the oven, or turn ON or off an electronics appliances you can have access to them all remotely with just a little taps on your mobile phone or smartphone. However, the additional features you increase no your mobile phone or smartphone, the additional data you store in the gadgets. This might make mobile phones, smartphones, or whatsoever link to them defenseless to a throng of various kinds of intrusions. Below are the security measures one needs to take to aid secure your security system against criminals or hackers. That is the reason why it is a perfect concept to safeguard your ordinal life by safeguarding your internet of things linked gadgets.

1. You have to install trustworthy internet security software on your tablets, computers, smartphones or mobile phones. For example, Norton Security Deluxe can offer real-time safety against current and initial malware, including viruses and ransomware.

2. By making Used of tough and matchless security PINs for your gadgets accounts, Wi-Fi networks, and linked gadgets. You should avoid making use of common passwords to protect your devices that can be guest by anyone for instance 123456 or ABCDE.

3. You should be very careful with the types of applications you make used to monitor your devices or security system. You should make sure you go through the privacy policy of the applications you are going to make use of to see how it is designed to make use of your personal information.

4. Gadgets become insolent because they gather much private information. Although gathering information is not necessarily an evil thing, you have to know what kinds of information these gadgets gather, how it is protected and stored if it is shared with third parties and the guidelines or protections regarding information breaches.

5. You should make sure you know the types of information the gadgets or applications need to have access to your smartphone. If it seems pointless for the application performance or too dangerous, then you have to reject authorization.

6. By making use of a virtual private network (VPN), like Norton Secure VPN, which will aid in securing the information conveyed to your home or public Wi-Fi.

7. You should make sure you check the gadget producer's website frequently in case they are firmware updates.

8. You should use carefulness when making use of social sharing features with the applications. The social sharing features may likely disclose your data like your location where you are currently are and let people know that you are not at the place needed to be secure or your home. Cybercriminals may likely use this to track your movements.

9. You should make sure you never neglect your smartphone if you are making use of it in open or public places. In congested places, you should make sure you turn off Bluetooth or Wi-

Fi access since you do not need such functions. Because someone may likely have access to your network and this may lead to hacking on your system especially when the Wi-Fi or Bluetooth do not have passwords.

4. Importance of installing the security alarm system

The rate of Crime in the world is increasing day by day due to urbanization, unemployment, poverty, economic recession, and social inequality, which will bring chaos to the country. Most of the crimes that are usually done are abduction, robbery, theft and housebreaks, but the most common one done today is armed robbery. This disturbing increase rate of crime in the world today, thus, threatened the life and properties of the people. A security alarm system should be installed as a standard device in our homes or the environments needed to be secure. The need for an operative and cost-effective system that caters to catastrophes and accomplishes safety concerns while one is away from their home is essential.

Therefore, a security alarm system is an essential device in protecting organizations, industries or buildings and improving the quality of people's life since is going to be an actual means of decreasing the threat of abduction, burglary, and thefts in the world today. Therefore, the importance of installing the security alarm system are listed below;

1. Research has revealed that the installation of a security alarm system at our homes can prevent criminals from entering the secure area. As a result of this, you can leave comfortably with your family at all times or even if you are away from your home or the environment needed to be secure.

2. With the help of modern technology today, security alarm systems may include many computerization features. These features will allow you to monitor your energy consumption and turn off all the utilities when you are not going to make use of them or no longer in the room. This may help in less monthly billing of the electrical appliances and less lost energy that is by the use of the internet of things (IoT).

3. With the help of the installation of the security alarm system installed, one can watch over his house and what is happening around the environment or surroundings to be secure.

4. The sound of the installed security alarm system can secure the thief especially if the system is connected to a buzzer, which will make a sound if they are an illegal entering.

5. Many of the security insurance companies or agencies usually offer discounts to those who are interested in installing the security alarm system which is a great way to reducing the costs of installation and it encourages people to install it because of the discount of installation.

6. The alarm security systems usually give an early warning in the case of a fire outbreak which will call the attention of the house-owner or people living in the area the system is installed and necessary measures will be taken.

7. With the help of the security alarm system installed, it may prevent the loss of valuables and properties which can lead to gigantic financial damage.

8. The installation of the security alarm system may provide the environment to be secure or homeowners with self-confidence and relaxation of the mind that their properties or homes are secured.

5. Conclusion

The objective of this review is to give awareness of the advancement in technology using internet of things (IoT) of the security alarm system and to create awareness regarding the security measures one has to take regularly due to increasing in break-in and abduction in the world nowadays and the challenges faced when the security system is linked to an internet and how to protect the whole system against cybercriminals attacks. This research reviewed some study on security alarm system from how it is originated which has not been done in most of the research papers and its advancement in technology aspect and list the importance of installing the security alarm system in the environment we need to be secured or our homes. The research also fills the gap for the need of installing a security alarm system against invasion in our homes today and the area needed to be secure. Especially with its advancement in technology using the internet of things (IoT), one does not need to get a security guard or hired someone to be watching the environment needed to be guarded.

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The Various Types of sensors used in the Security Alarm system

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ABSTRACT

The most basic definition of any security system is generated from its name; it is literally a means or method by which something is secured through a system of interworking components and devices. With the help of the latest development of technology, it is possible to secure people's lives, industries, schools, organizations, and homes using an alarm security system that will monitor, guide and protect against burglar and abductors, because of the rate of theft and abduction in some parts of the world is increasing by the day; this imbibes fears that become a threat to the peace and economic development of any society or country nowadays. It is paramount to find viable technologies that will secure the lives of humans as countermeasures to tackle this kind of problem. This paper will review literature related to security alarm systems, different types of sensors used in the security system, advances in its technology, and disadvantages of installing the security alarm system and the importance of installation for security purposes in which most of the papers I read did not.

KEYWORDS: Abduction, Alarm System, Burglar, Security, and Sensors.

1. INTRODUCTION

The security alarm system likewise offers a great means for supporting and helping different needs of folks that have disabilities precisely old age people or individuals with a certain illness that will not allow them to be moving around either in offices, organizations or homes. The user of the home automation and its application area is very significant and will keep on steadily upsurge even in the future [1]. The security alarm system or home automation is also known as the automation of the placed is installed or household activity. The home automation or security system usually explains a house or an area that is a link with technology and services through networking to watch over the area needed to be secured and increase the eminence of living of people. The security alarm system or home automation comprises centralized control of lighting, appliances, temperature, and other systems, to provide better relaxation, ease, security, and efficiency.
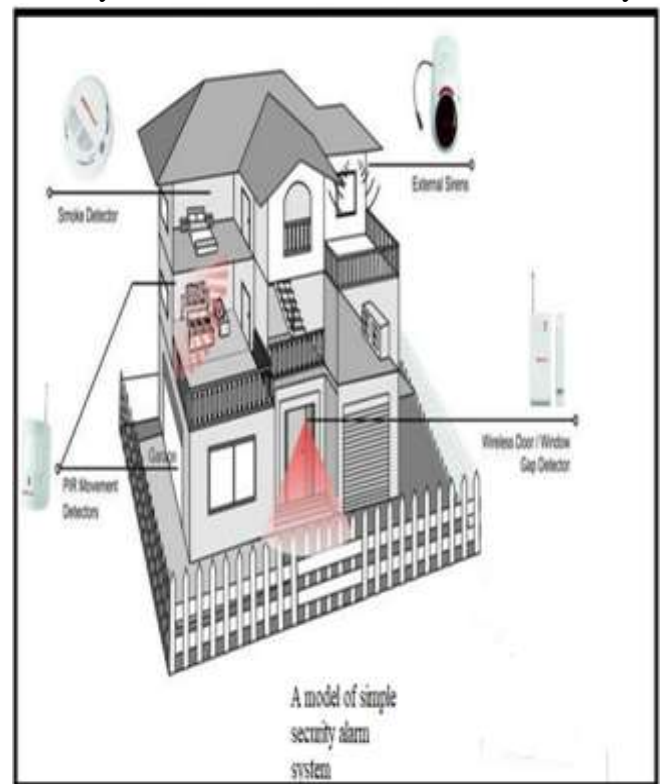

Figure 1: A model of a simple security alarm system.

Today, our home monitoring and alarm security systems have become common. One of the motives for this is the increase in crimes, abduction, and robbery in the world today. Many of our homes, industries, schools, and organizations today are invade mostly by force either through a criminal entry or through

breaching a window, entering through a cutting celling or even entering through a closed door or sometimes even an open window [2]. Case studies show that most criminals are usually cut off by the help of the simple existence of an alarm security system in our homes hospitals, schools, organization, and industries. Criminals usually invade far more defenseless constructions compared to those guarded by security alarm systems. The improvement of the security alarm systems started with the creation of man. To give threatening information, human being implements a form of a signal, shout, and sound. It was then replaced with the help of the clapping of hands and with the instilling of signals to notify society or to blowout a certain message during the early periods of some African society [3]. All these methods of warning are fundamental, unreliable and unsystematic. With the help of advancement in technology today, these undeveloped methods of producing security alarm systems were changed by programmed security alarm systems in the late eighteenth period. These types of electronic security alarm systems usually work without the aid of any human being energy. When the modern security alarm system senses a positive signal which may be a sign of intrusion or breakage, it normally gives a warning of a very high sound or sends an alert to the owner subject to the type of security design [4]. The earliest electronic fire, security alarm system was developed by a man named William .F. Channing. Late on an electrical electronics engineer, Mr. Moses G. Farmer invented the construction. This alarm system uses automatic indicator boxes to label the position of the outbreak fire and was first lunch in Boston, United States of America. The development of this alarm system by Dr. William was then followed by the improvement of various stylish and difficult fire and intruder security alarm system technology that is so many to deliberate [5]. The most significant among these security system technologies is the use of remote signaling thief security alarm. This type of security alarm system was design in the early 1970s. This administers a fast inventive reaction to alarm calls. However, organizations and industries are based on the supply of security service apparatus that usually come in dissimilar designs to keep burgles and thugs away from the

environment that are not built for them. Today, we have an innovative group of electronic security alarm system with complexity at various levels [6]. With the latest flow in crime rates in the world, it has become very essential to safeguard our buildings and our property with the aid of sophisticated stages of various advanced security alarm devices. The prices of such kinds of security alarm devices depend on the apparatus technology and solicitation desires. These alarm security system devices are characterized by present electronic security alarm systems. Some of nowadays-modern security alarm systems are housebreaker alarms, threat alarms, industrial alarms, speed limit alarms, and anti-theft vehicle alarms [7]. The intruder alarm security is initiate by a cycle, from a comprehensive automated circuit loop that is close with an alarm at its output, or an indication to inform the owner of danger. They are a central control box that normally observer different gesture indicators and the perimeter protections that give an alarm or notify the owner when any of this sensor is a trigger [8]. Some of the intruder's security alarms system normally functions delicately on the conception of a magnetic contact and others. For those types of security systems working with the sensors, these devices are usually positioned at any entering of the industries, organizations, and building. In this case, the sensor will activate an alarm if the device gets a signal above its set inception [9]. In the case of motion detection, the ultrasonic sensor is normally used; the point indicator can be used in the concession of a criminal alarm, theft or illegal individuals at certain points such as doors or windows [10]. For instance, when a precise environment needs to be look over the awareness of the burglar in the protected environment is used, which is executed with the help of ultrasonic sensors and is normally fixed at an appropriate location. Presently, closed-circuit television (CCTV) shown in figure two below, has been combined in the thief security alarms system to recognize the existence of illegal personnel.

Figure 2: A model of closed-Circuit television (CCTV)

The output of the intruder alarm system can differ from grief sign or loud bell cautionary to automatic telephone buttons and flashing outdoors rays [11]. It accomplishes the warning purpose possible of informing neighbors of an illegal individual and at the same time, it will function as a signal to the police. Automated dialers linked to the burglar alarms are set to call the police officials and to play a pre-recorded report notifying the police personal that the organization, industries or house has been break into [12]. With the aid of advances in technological and scientific improvements, it has made significant advancements in the technology of the security alarm devices [13]. In this research, advances in security alarm system technologies against intrusion are review considering an intruder alarm. A security alarm system has been a great concern in the world nowadays, considering the surge in burglaries in different parts of the world today and the rise in abduction, everyone needs to take protective actions to avoid an illegal entering into their industries, organizations or homes [14]. The point that security alarm system exists in our environment or homes is often a hindrance to frighten a burglar before trying to force an entry, making the possessions of it in our home or environments, will make you feel safe and increase peace of mind to the users [15]. These devices function as inputs that trigger the security alarm. Some of the security alarm

sensor technologies that have been established over the centuries are

(1) Microwave sensors: the microwave sensor, is an electronic device that perceives signs and is used to control luminaires. The microwaves function differently from passive infrared sensors, by extruding microwaves, which bounce off surfaces and return to a sensor within the indicator. The microwave sensor can easily perceive any activities within its range and do all this in less than a microsecond. The microwave sensors can easily penetrate the hole and walls. Because of its ability, it can cover a very larger area of commercial properties, industries, organization and homes that needed to be secure. Because its properties are required to make use of it especially for, those who want to secure a very large environment. The microwave sensors are mostly less expensive to buy. The microwave sensor is motion-sensing devices that normally flow in a definite area or in the area within the electronic field. Movement in or out of the area that needs to be secure quickens the speed and triggers the alarming figure three below shows the image of the microwave sensor.

Figure 3: Microwave sensor
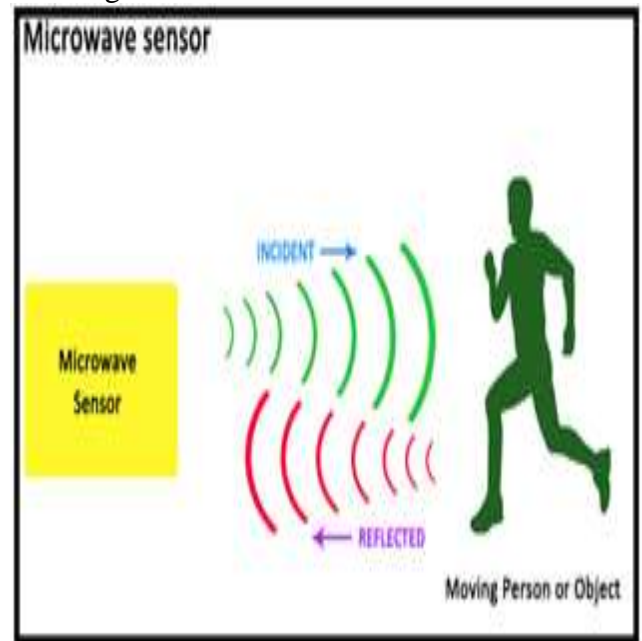
(2) Vibration Sensors: Vibration sensors are sensors that are used for displaying, measuring, and evaluating linear velocity, displacement, acceleration, and proximity. Vibration sensors are usually fixed on ceilings, floors, and walls to sense mechanical vibrations produced by drilling, chopping, or because of any physical attack figure, four below shows the image of the vibration sensor.

Figure 4: Vibration sensor

(3) Photo electrical ray sensor: The photoelectric sensor usually discharges a light ray infrared or visible from its light-emitting element. A reflective-type photoelectric sensor is usually used to notice the light ray reflected from a certain target. While a thru beam, type of sensor that is to measure the changes in the light magnitude caused by the target passing through the optical axis. The photoelectric sensors usually transfer infrared beam to the receiver, usually in the form of a light ray, in a remote area, thus forming an electronic fence. These types of sensors are usually used to close openings, such as corridor paths or doorways, which are broken open. Whenever the light ray is disturbed or interfered, it will automatically produce an alarm signal figure five below shows the image of the photoelectric sensor.
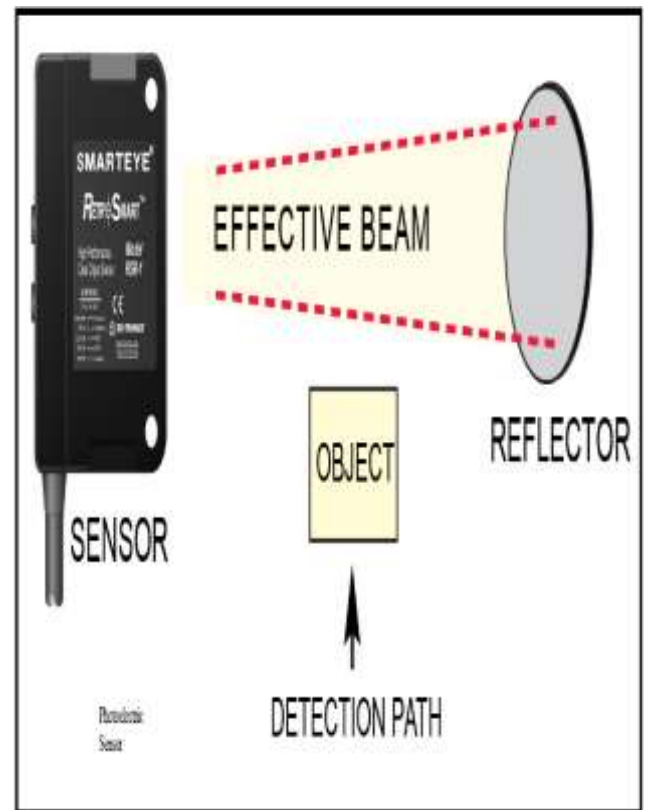

Figure 5: Photoelectric Sensor

(4) Electric field sensors: The electric field sensor is a micro-electronic based device that can normally notice the existence of both stationary and moving objects through solid materials. Its facility to function through any non-conductive material permits complete invisibility. The electric field sensor function by noticing any small changes in an ultra-low-power electromagnetic field produced between two remotely positioned antenna electrodes. These sensors normally create an electrostatic field between and round a series of conductors and an electrical ground. Is for identifying up and down or degradation in the field. The sensor can be activated by anybody touching or approaching the sensor figure, six below shows the image of the electric field sensor.

Figure 6: Electric Field Sensor

(5) Sound sensors: The Sound Sensor is usually a minor board that is merging with a microphone and some processing circuitry. It produces not merely an audio output, but also a binary sign of the presence of sound, and an analog exemplification of its amplitude. These sensors usually react to the sound generated by intruders entering through the secure environments figure seven below shows the image of the sound sensor.

Figure 7: Sound Sensor

(6) Capacitance sensors: Capacitive sensors can normally be used to identify metallic substances as well as close all additional tools like liquid and solid substances. The capacitive sensors are frequently used as a limit switch, for flow control, object detection and for counting purposes. The capacitive sensors notice variations in the electric field. Whenever an intruder gets closer to it or by direct contact with the sensor wire, it brings about changes in the capacitance of the field, which can either be a higher or lower level than the verge signal level, this will automatically generate a signal figure-eight below shows the capacitive sensor.

Figure 8: Capacitive Sensor

(7) Glass break detector: This type of sensor is used in electronic criminal alarms detectors if a piece of the glass is broken or shattered. The detectors are usually kept or fixed closed to glass storefront windows or glass doors in our houses, offices or organizations. The glass break sensors generally either use a microphone, which observer's vibrations or noise that is coming from the glass. If this noise or vibrations surpass a certain verge that is user-selectable, they are evaluated by sensor circuitry the figure 9 below shows the glass break detector.

gadgets in detecting closing or opening of windows or doors. The detectors are reliable and cheap. This type of sensors usually comprises two sections, a contact that is usually installed on your window or doorframe and an activating magnet that is mounted on the door figure 11 below shows the magnetic contact detectors.

Figure 9: Glass break detector

(8) Seismic detectors: This seismic sensor is useful for watching over armored cabinets, automatic teller machines, cash boxes, armored safes, night safes, and safe vault walls for all known break-in apparatuses such as oxygen lances, diamond-tipped drills, explosives, and hydraulic rams. Any mechanical vibrations triggered by a break-in attempt are scrutinized and detected by this seismic detector sensor, and an alarm will be triggered figure 10 below shows seismic detectors.

Figure 11: Magnetic contacts

In this research, we have seen how we alert our neighbors if an intrusion occurs since the previous years before the introduction of various types of sensors that are used in the security alarm system and how they operate and function. We have also seen how essential the security alarm system or home automation system is very important. How its main uses range from expanded relieve and larger security and safeness, and to additional reasonable usage of other resources and energy, granting major savings [16].

2. RELATED WORKS

Presently, security alarm system manufacturers for building and alarm lookout facilities give a variety of means proposed for clients to supervise their alarm security systems, in case they are far away from their organizations, industries or home. Motivated by the encroachment of recent technology and the surge in abduction and robbery in the world today, which as result has appealed major consideration. This segment will discourse study associated with our studies on security alarm system against invasion, which will come both from local and foreign studies.

Figure 10: Seismic detectors

(9) Magnetic Contacts: This magnetic contact is most usually use in electromechanical appliances that trigger when the magnet and contact are alienated. It is mainly used on windows or doors, these switches are the prevailing detecting

2.1. Local studies

In the designed of a simple dependable touch delicate security alarm system that is inexpensive since there is the accessibility of the component that they used with an abundance of close substitute of the components. An additional reason you have to consider was reliability when the power for the security alarm system is down; you have integrated the system with programmed change over to a power supply which will guarantee you with the constant power supply to your circuit. Moreover, the effectiveness of the system has to be taken into account by making use of a transistor to couple the microphone. In additional effort to make an alarm security system, developing an automatic alarm security system. The system has to comprise of an indicator and a sensor as a transducer for detecting intruders' activities or breaching beyond the gate or environment needed to be secured. The signal is at that point handle by a fixed microchip that activates the phone component and sends a short message service (SMS) notice to a mobile cell phone at your organization, industries or homeowners, which triggers a linked alarm structure. A study project containing the make use of a Short Message Service-based invasion recognition system, which will consist of a headset, antenna and switch circuit. The structure combines motion devices, not like unoriginal magnetic key alarms in entries and openings, such that a short notice will be sent to the owner in an effort to rob the owner organization or house or if abduction is about to take place. The design can be constructed by the means of an Arduino or microcontroller programmed with different components like motion sensors, and controls. A movement sensor usually called the Passive Infrared ray (PIR) sensor shown in figure twelve below is inserted into a prototype rooftop and a button near the entrance door or window so that dispatch is shown whenever a trespasser passes the passive infrared ray (PIR). An (LCD) Liquid crystal display will show a message which now will be sent via short message service to the embedded mobile numbers figure 12 below shows the model of the passive infrared sensor ray detection and how it works.
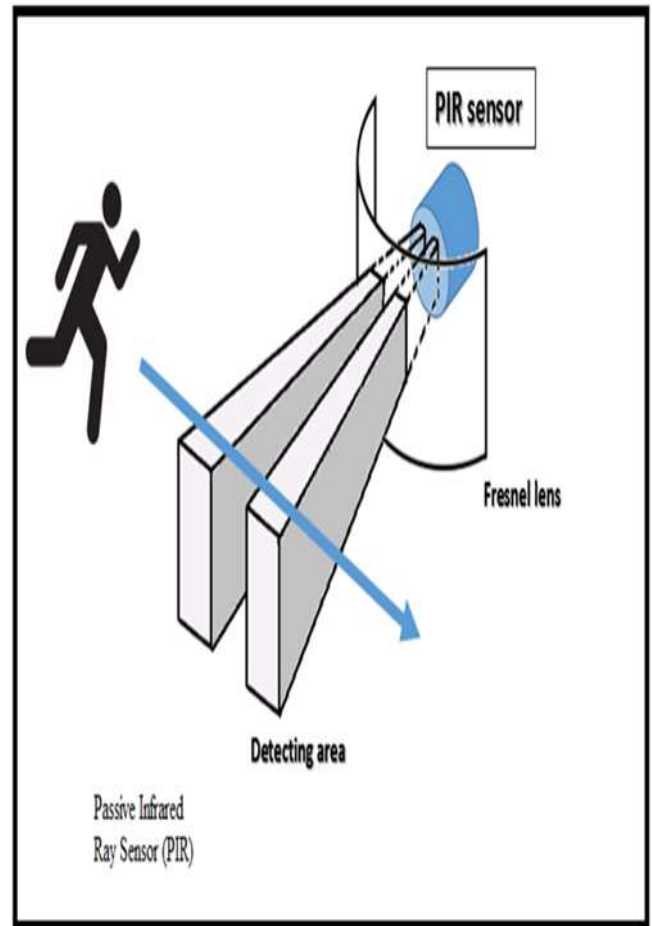

Figure 12: Passive Infrared Ray Sensor

2.2. Foreign studies

This area of study is consisting of a mobile security alarm system that will automatically dial an automated mobile phone number linked to the security system in case they is an intrusion in the secure environment and the system will then send a message immediately to the sensor of the programmed security system device it will then be activated. The construction of the circuit will consist of either an Arduino or microcontroller in the programming process which will serve as the brain of the system, with also various sensors to avoid misleading mistaken alarms driven by another anguish watching system. The system is going to be linked to both the owners and the people watching the secure environment which can be your house, private organization or government agencies and also to both the owners phone number, police unit and fire services unit in case they are any intrusion or fire outbreak it will automatically send a message to the house, organizations, industries and the people monitoring the secure environment, and the people monitoring the secure environment will send it to the police, in case it is a fired outbreak

the people monitoring the secure environment will send it to the fire service unit because of the various sensor installed for their different purposes in the configuration of the security system figure thirteen below shows a simple model of the foreign studies on security system and how it operates. This type of system can also help guard the environment to be secured from robbery or abductors when you are away from either your organization or home. That is whenever someone is trying to rob or abduct someone in the secure area or house, the security alarm system will be activated which will then automatically send a short message service (SMS) to the house owner's mobile phone and to the security agencies watching over the secured environment.
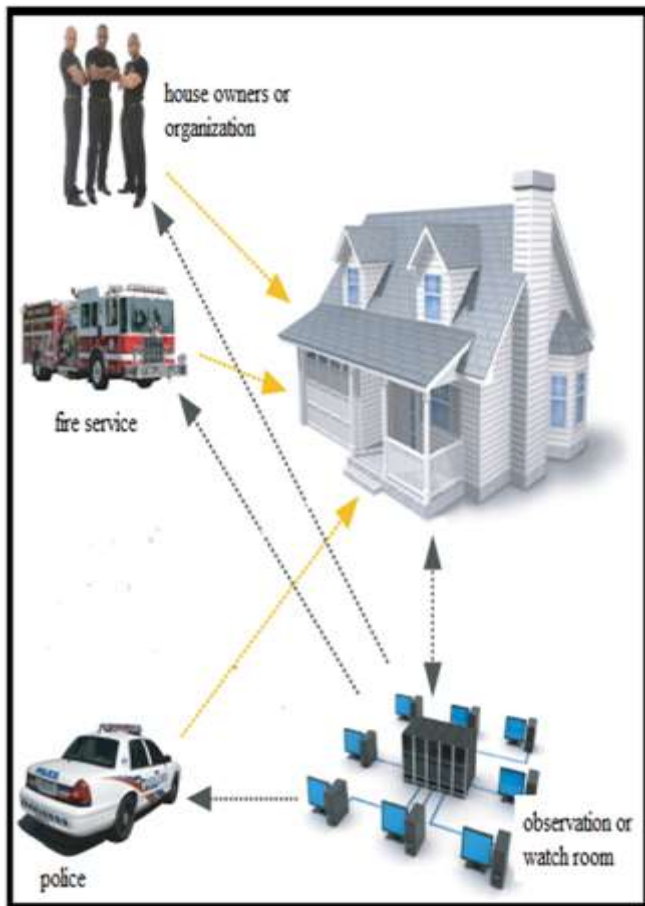

Figure 13: A model of the simple security alarm system of foreign studies

3. Importance of installing the security alarm system

The rate of Crime in the world is increasing day by day due to urbanization, unemployment, poverty, economic recession, and social inequality, which will bring chaos to the country. Most of the crimes that are usually done are abduction, robbery, theft and housebreaks, but

the most common one done today is armed robbery. This disturbing increase rate of crime in the world today, thus, threatened the life and properties of the people. A security alarm system should be installed as a standard device in our homes or the environments needed to be secure. The need for an operative and cost-effective system that caters to catastrophes and accomplishes safety concerns while one is away from their home is essential.

Therefore, a security alarm system is an essential device in protecting organizations, industries or buildings and improving the quality of people's life since is going to be an actual means of decreasing the threat of abduction, burglary, and thefts in the world today. Therefore, the importance of installing the security alarm system are listed below;

1.   Research has revealed that the installation of a security alarm system at our homes can prevent criminals from entering the secure area. As a result of this, you can leave comfortably with your family at all times or even if you are away from your home or the environment needed to be secure.

2.   With the help of modern technology today, security alarm systems may include many computerization features. These features will allow you to monitor your energy consumption and turn off all the utilities when you are not going to make use of them or no longer in the room. This may help in less monthly billing of the electrical appliances and less lost energy that is by the use of the internet of things (IoT).

3.   With the help of the installation of the security alarm system installed, one can watch over his house and what is happening around the environment or surroundings to be secure.

4.   The sound of the installed security alarm system can secure the thief especially if the system is connected to a buzzer, which will make a sound if they are an illegal entering.

5.   Many of the security insurance companies or agencies usually offer discounts to those who are interested in installing the security alarm system which is a great way to reducing the costs of installation and it encourages people to install it because of the discount of installation.

6.   The alarm security systems usually give an early warning in the case of a fire outbreak which will call the attention of the house-owner

or people living in the area the system is installed and necessary measures will be taken.

7. With the help of the security alarm system installed, it may prevent the loss of valuables and properties which can lead to gigantic financial damage.

8. The installation of the security alarm system may provide the environment to be secure or homeowners with self-confidence and relaxation of the mind that their properties or homes are secured.

4. Disadvantages of installing the security alarm system

Not all the papers I read discussed the various disadvantages one may like encounter if the security systems are installed.

1. Privacy: There have been a few instances in the past where security cameras have stirred up controversies, especially in professional setups. There have been cases where employees have objected to being under constant surveillance without their permission and citing the 'invasion of privacy' as the reason. A few have also resorted to taking legal action against their employers in relation to this. Critics of security camera systems have taken offense to them being placed in offices and argued that doing so implies that the employer has either already assumed or is convinced that his employees are up to no good and will do something wrong which is why their activities need to be recorded.

2. Expensive: While dummy cameras may not be expensive, the real ones cost hundreds, even thousands of dollars depending on the features and the number of cameras and monitoring systems you buy. Getting them installed and their maintenance means added costs. If you are thinking of installing them yourself, lay that idea to rest unless you have good knowledge of wiring systems or you may end up damaging the cameras.

3. They can be Vulnerable: When we, as users of security cameras, try to keep ourselves updated on the latest in security systems, we should not forget that intruders and criminals are doing the same too. A clever trespasser will probably know all about them and may have figured out a way to go undetected. Further, tech-savvy criminals might have understood the technology and worked out ways to disable/disconnect them from their power source. In addition, if he

detects your cameras as fake/dummies, they can be useless in any crime prevention. In worst cases, hackers can play havoc with your security camera system by using the Internet and use them to spy on you instead.

This makes security cameras vulnerable to damage and/or misuse.

4. Can't Stop Theft: Cameras enable users to record footage for later viewing, and to help nab criminals, and receive justice from the law. They cannot, however, stop a crime when it is in progress. They do not alert neighbors or the police like an alarm system would. This means that you will incur losses even as you run to the court, make insurance claims and reorder stolen inventory, which may no longer make you feel absolutely safe and even cause you to lose faith in them.

5. Conclusion

The objective of this review is to give awareness on the advancement in different types of security alarm sensors used against abduction and intrusion and to create awareness regarding the security measures one has to take regularly due to increasing in break-in and abduction in the world nowadays. This research also reviewed some study on security alarm system from both local and foreign aspect and list the importance of installing the security alarm system in the environment we need to be secured or homes and also the disadvantages of installing the security alarm system in which most of the papers don't. With the security alarm system, one does not need to get a security guard or hired someone to be watching the environment needed to be secure.

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A Study for Improvement for Reinforcement Learning based on Knowledge Sharing Method
— Adaptability to a situation of intermingled of complete and incomplete perception under an maze —

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ABSTRACT

This study aims to improve maze-solving technique, efficiency by which to the reinforcement learning agent under the situation of using incomplete sensors. In Reinforcement Learning, this method will be supposed that agent is able to observe the environment, completely. However, there is a limit on the information of the sensors. Moreover, it is hard to learn the Reinforcement learning agent in the actual environment cause of some noise of actual environment or source device. In this study, the proposed method has been using two types agent that included complete perception and incomplete perception and exchange of information on the location to settle this problem. This study aims to improve maze-solving technique, efficiency by which to the reinforcement learning agent under the situation of using incomplete sensors. As a result, the proposed method has been confirmed that is provided suitable solution for an approach to the goal for incomplete agents.

KEYWORDS

Mobile Robot, Knowledge Sharing, Reinforcement Learning, Incomplete Perception, Maze Problem, Q-learning.

1 INTRODUCTION

In recent, many studies have been conducted with the objective of facilitating the working of robots in dynamic environments [1]-[3]. Various robots have been developed to assist humans in workspaces, such as a house or factory [4]. In general, robots are required to work effectively and safely in a dynamic environment to achieve their tasks. However, it is not easy to make a robot behave like a human in dynamic environments [5, 6]. When they are working in a certain environment, humans select an appropriate course of action through subconsciously predicting all the changes in the environment and their next state. For achievement these problems, in recent years, various machine learning methods have been suggested. In reinforcement learning, it attracts attention as the technique that often use in the actual robot [7]-[11]. However, reinforcement learning has some problems. In one of the problems, a robot does not cope with changing purpose in reinforcement learning. Reinforcement learning has been demanded to achieve various purposes, because what request to robot is diversifying and to achieve various purposes in robot have been wanting, as mentioned above. Therefore, it is important to solve this problem.

Until now, in reinforcement learning, a knowledge sharing often hasn't been adjusted dynamically [12, 13]. However, this knowledge will be an index of performance in the reinforcement learning. In this study, agents learn using information from the knowledge for a task as known as Q-space of another agent, will be suggested. From this proposed method, the knowledge space will be adjusted from other agents' behavior, dynamically. In Human Life, an "*teaching*" will be existed as a communication method. For example, empirically, people will be influenced by "*knowledge teachning*," such as in the situation of working, or someone shows somebody a way to purpose area. In this study, this point of knowledge sharing as motivation for task achievement of agent will be defined. Moreover, in this study, agent's action decision when another agent will solve the task, will be focused on. In other words, an agent will be trying to obtain an optimal solution from another agent if other agents have been found an optimal solution.

In this paper, we propose the action decision based on other agent's knowledge space. Moreover, in this study, we discuss effectiveness using a maze problem as an example. As a result, we confirmed that the proposed method is well influenced from other agent's behavior.

This paper is organized as follows: In section 2, we explain the how to obtain the knowledge space from other agents' behavior, dynamically. In parallel, we provide details about the proposed method. In Section 3, we explain about the setting for the experiment. Finally, in Section 4, we present the conclusions of this study.

2 A CONCEPT OF ACTION-DECISION BASED ON OTHER AGENT'S BEHAVIOR

2.1 Basic Idea

Humans are living beings who form a group for living. In their life, it is common to do some work or job. If someone doesn't understand how to do or if he can't do it, in that case he will learn how to doing it from another person.
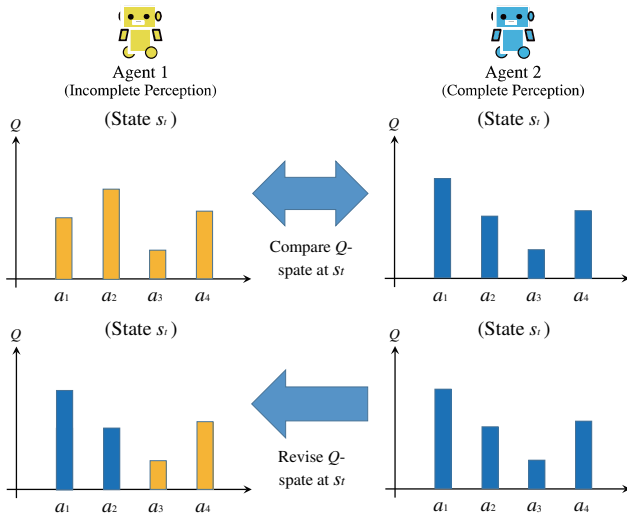
We can be called that method "*teaching*." For example, if someone start a new part-time job, firstly, he will learn how to service or hospitality from his superior. Moreover, the procedure and the flow of work from his superior will be learnt, because he doesn't know what he do and how it moves, initially. Or else, there is also the possibility to ask a person who knows the work content or judge by looking at the behavior of the person working around. Thus, if people have something that don't know, they will act naturally as "*listen*" or "*observe behavior*" to the person who knows the method, during in social living or group.

In this paper, a mechanism what "*obtain a knowledge from something else if it has something that doesn't know*," has been implemented on the reinforcement learning, will be tried. Moreover, from this mechanism, we will try to improve a behavior that an incompletely perception agent will be behaving as similarly as completely perception agent.
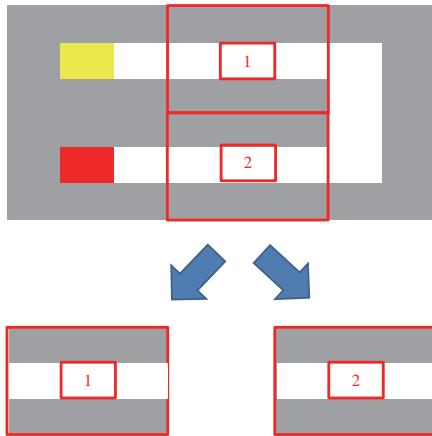
Next, the underlying mechanism of reinforcement learning will be described, briefly. In reinforcement learning, an agent which has a part to decide action choices and a part to calculate reward will be received the state and the rewards when a certain action is taken. The reinforcement learning will be created Q-space that contains "*how to take an optimal action in the state for maximize reward.*" By updating this Q-space with every trial, this algorithm will derive an optimal solution. In actual situations, it is very difficult to observe the state of the environment by the sensor's readable value, or imperfection will be remained due to noise mixing. Thus, this problem will be disturbed the optimal solution (as shown in fig. 1). In order to enable agents with imperfections, in such state observations to derive optimal behavior, the proposed method of this paper will be applied.

2.2 How to Share with Other Agent ?

The Q-space will be considered in case of share between two agents. This sharing method will be considered from communication method in human life.

In incomplete perception, it is difficult to cognition where it is in as shown in fig. 2. At this time, there is an uncertain portion in the state observation. Therefore, there is a possibility that maximizing the reward will cause problems and it will be difficult to obtain the solution of the maze. If it is possible to communicate with an agent capable of completely perception which the environment is observed (fig. 1), agents with uncertainty in observation of the environment can also maximize rewards, and it is possible to derive the optimal solution.

In the previous section, we described that

Figure 1. Aim of this study (situation).

Figure 2. Difficulty of dividing the status for Incomplete Perception.
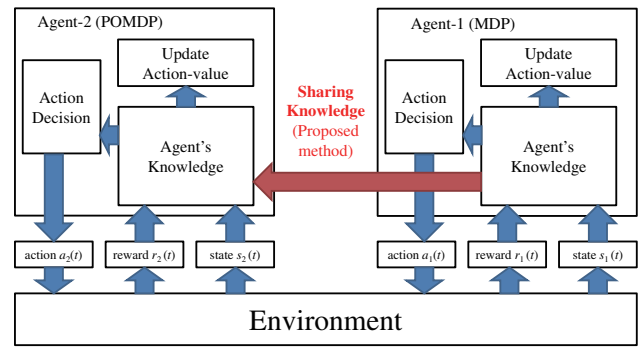
Figure 3. An Outline of the Proposed System.

the optimal solution can be derived by an agent with uncertainty by experience information with an completely perception agent through complete communication with the completely perception agent. In this paper, we aim to solve the problem, and construct a proposed system as shown in fig. 3. In this figure, the basic structure is same as the ordinary reinforcement learning; action a_t is performed in a certain state s_t, reward r_t accompanying it and the next state s_{t+1} are received. At this time, in ordinary reinforcement learning, the flow of deriving the optimal action to take next from this point a_{t+1} by updating Q-space, will be determined.

In the proposed method, the Sharing Knowledge method, will be added. In this method, the agents communicate with each other. In detail, their Q-spaces will be compared with each other; when two agents are in the same environment and each of them has updated the Q-space, one of the agents can communicate with the other agent. At this time, if one of the agents obtained better results during the

episode, another one also applies the result to the Q-space.

$$Q_i\left(s_t, a_t\right) \leftarrow Q_c\left(s_t, a_t\right). \qquad (1)$$

In this equation, Q_i denotes incompletely perception's Q-space, and Q_c denotes completely perception's one. From this result, the agent will obtain the best action on the Update Action-value part, and the next action on the Action Decision part will be taken.

Thus, we will add any information that not only state, action, and reward for necessary to update Q-space, but also part of communicate and obtain the Q-space from another agent as known as experimental information or knowledge space. When this is done in the case where there is uncertainty in the state observation mentioned earlier (fig. 2), even if state observation can't be performed accurately, derivation of the optimal solution that will be possible to guess. In this way, the agents will behave in accordance with the behavior and state of other robots so that people obtain and act around the "*atmosphere.*"

3 VERIFICATION EXPERIMENT – COMPUTATIONAL SIMULATION USING THE PROPOSED METHOD

3.1 Outline of the Experiment

Let consider the maze environment with walls consisting of a grid of 6×9 shown in fig. 4 as the experimental environment. Moreover, the agent implemented a proposed method will be affected by other agent during task execution. We verify the effectiveness of the proposed method up to the previous section by computer simulation. The effectiveness is evaluated by comparing the difference of the convergence speed of the learning of the completely perception with the proposed method. At this time, agent-1 which the completely perception agent is to learn the route that reaches the goal while avoiding walls through trial and error, and the reinforcement learning to which the proposed method is applied. Other agents will be shared Q-space from agent-1 when encounter agent-1 in communication area in fig.

4. Behavior will be selected according to behavior facing.
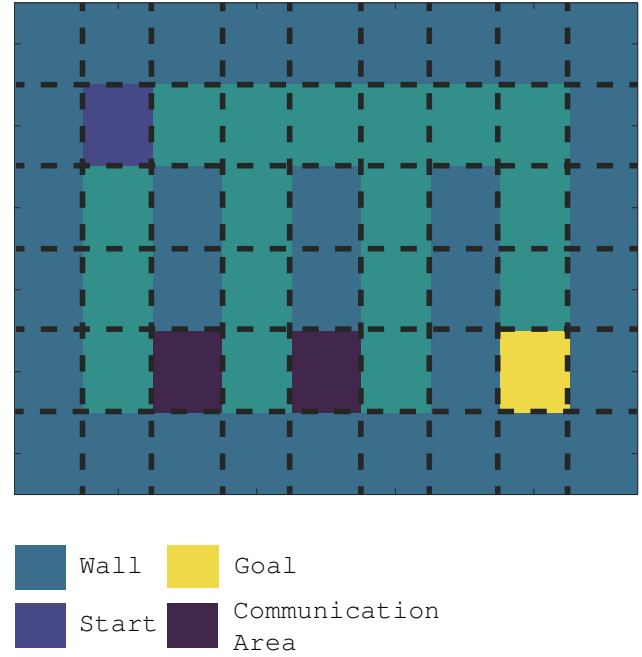
Figure 4. An Experimental Environment (Grid Maze).

In figure 4, the indigo-colored mass is the wall. The completely perception and incompletely perception agents are perfect perception and can move up, down, left and right of the grid. In case of reaching to the communication area and an incompletely perception agent getting a knowledge from a completely perception agent, or get a reward +1 when agent reaches the goal point (yellow-colored mass).

**Table 1.** Experimental parameters for Agents.

| Property	Initial value	Learning	Discount	Exploration
Agent	of Q values	rate α	value γ	rate ϵ
Agent-1	0	0.5	0.95	0.1
Agent-2	0	0.5	0.95	0.1
Agent-3	0	0.5	0.95	0.1
Agent-4	0	0.51	0.95	0.2
Agent-5	0	0.55	0.1	0.7

3.2 Condition of Simulation

In this experiment, we mainly deal with episodic tasks: agent-1 is a completely perception agent that operates with ordinary reinforcement learning, agent-2 through 5 are

incompletely perception agent that combines the proposed method and reinforcement learning. Agent-1 won't be affected by other agents' learning and behavior of other agents, agent-2 through 5 will select actions affected by agent-1 during knowledge sharing.

When each agent reaches the goal point from the start point, the reward is obtained and the process returns to the start. Treat this as one episode, moreover, in this experiment, we will do 100 episodes. Setting of experimental parameters is as shown in the following table 1.
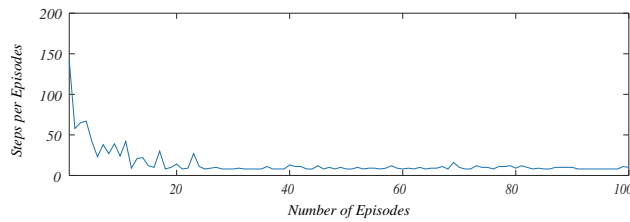
Figure 5. Number of Action per Episodes of Agent-1.
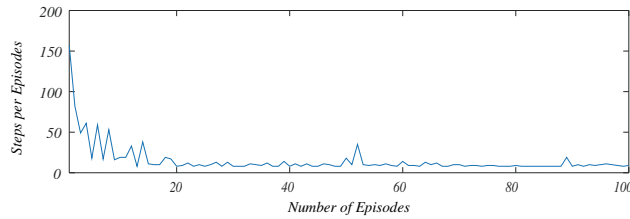
Figure 6. Number of Action per Episodes of Agent-2.
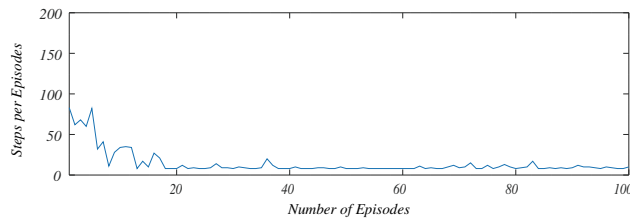
Figure 7. Number of Action per Episodes of Agent-3.

3.3 Discussion on Simulated Results
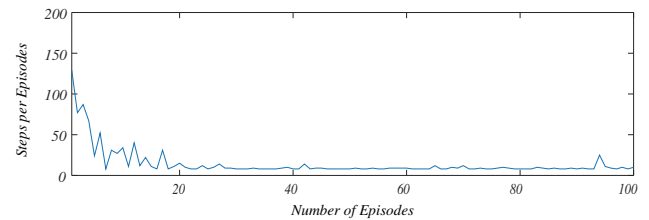
3.3.1 Focused on Action Transition

Figures 10 through 18 shows the results of the experiment. Figure 10 is the transition of the behavior in each episode by completely perception agent-1. Figures 11 through
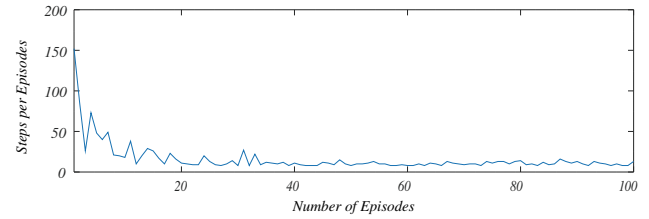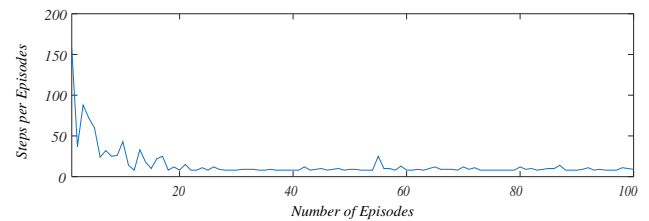

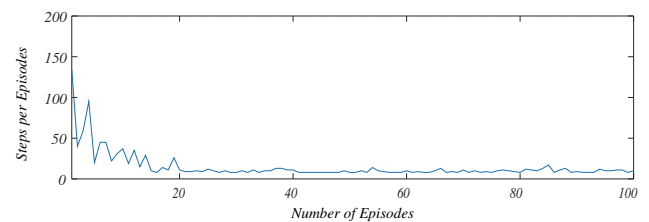**Figure 8.** Number of Action per Episodes of Agent-4.
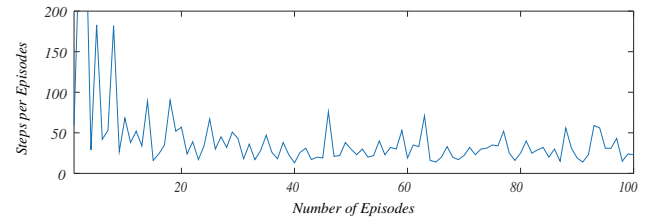
Figure 9. Number of Action per Episodes of Agent-5.

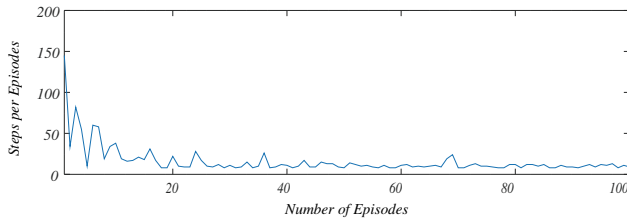**Figure 10.** Number of Action per Episodes of Agent-1.

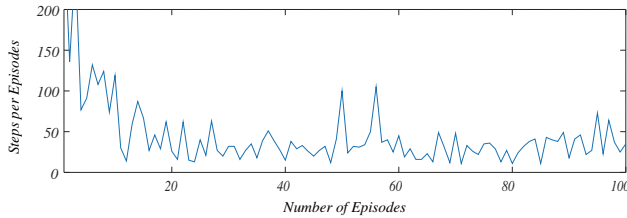**Figure 11.** Number of Action per Episodes of Agent-2.

Figure 12. Number of Action per Episodes of Agent-3.

Figure 13. Number of Action per Episodes of Agent-4.

Figure 14. Number of Action per Episodes of Agent-5.

14 are the transition of the behavior in each episode of agent-2 through 5 applying the proposed method. The initial value of learning is the number of the behaviors. From these results we can confirm that almost identical to agent-1, however, as learning progresses, that can be seen that it follows agent-1 that achieves episode with a fewer number of behaviors than agent-1. In figure 14, agent-5 won't convergent smoothly because of this agent is explorative.

In agent-2 through 5, Q-space is structured by each agents at the beginning of the action and chooses the exploratory behavior, however, as learning progresses, Q-space will be copied by agent-1, decreases to 0 as Agent-1's goal number increases, next episode. Moreover, in the next episode, Q-spaces will be used for reach to goal. From this result, we can conclude that each agents can be obtain the optimal solution and perform like a completely perception agent from agent-1 using contact area at early episodes.

### 3.3.2 Focused on Number of Contact with Each Agents

Figures 15 through 18 are the transition of the number of contacts with agent-1 in each episode of agent-2 through 5 applying the proposed method. From these results we can confirm that almost decreasing the number of contact, however, as learning progresses, that can

be seen that it follows agent-2 through 5 that achieves episode with a fewer number of behaviors than agent-1.

From these results we can confirm that almost decreasing the number of contacts during learning progresses. Moreover, agent-2 through 5 aren't contact with agent-1 since 20 episodes. From this viewpoint, we can also conclude that each agents can be obtain the optimal solution and perform like a completely perception agent from agent-1 using contact area at early episodes.
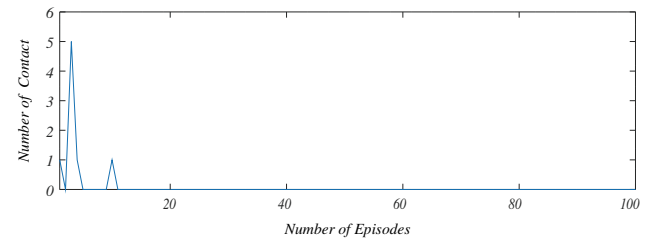
Figure 15. Number of Contact of Agent-2 with Agent-1 per Episodes.
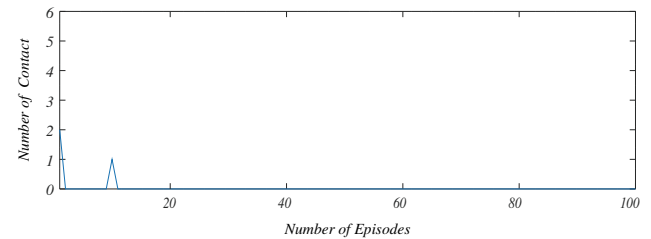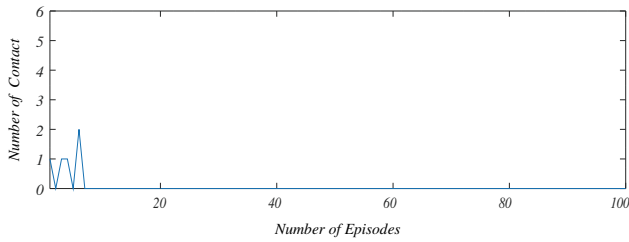

Figure 16. Number of Contact of Agent-3 with Agent-1 per Episodes.
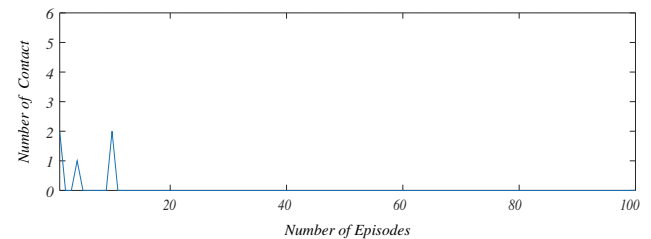
Figure 17. Number of Contact of Agent-4 with Agent-1 per Episodes.

4   CONCLUSION

In this paper, a method to dynamically share the knowledge space strategy based on

Figure 18. Number of Contact of Agent-5 with Agent-1 per Episodes.

other agent's behavioral results, has been proposed. In this method, the evaluation of other agent's behavioral results is its number of agent's task achievement. Moreover, in the proposed method, an area of communication for knowledge sharing with a completely perception agent have been defined. From this method, the simulation results showed the proposed method has been acquired actions to reach the goal as same as efficiently than completely perception method. In other words, the number of trials of proposed method's agent is less, while its agent will not be affected by another agent. Inversely, if another agent will be found the route to reach to goal with the shortest action number, the proposed method's agent will be decided the action that reach to the goal with the shortest action number, repeatedly, and affected by his behavior.

From these results, the proposed method has been confirmed to efficiently accomplish the task, while obtaining the knowledge of the completely perception agent. Therefore, we conclude that the usefulness of the proposed method has been confirmed. However, one of the remaining problems is that required higher CPU processing speed for increasing the number of agents. Another problem is updating Q value. Since updating the Q value depends on reliable observation of the environment. However, it is unlikely that the efficiency of convergence speed can be improved because many agents are involved in Q-space. Therefore, rather than increasing the number of agents, it's not possible to dynamically change the communication method. In detail, the method of communicating for the environment, learning rate, or the ratio of exploitation or exploration,

to bring the agent of incomplete perception closer to the perfect perception operation, will be needed. If the problem will be solved, we speculated that it would be closer to application to problems in real environments.

Now, let's consider the living thing, again. Especially, in Human Life, not only "*teaching*," but also "*atmosphere*" [15] or "*synchronization*" have been existed in social life, moreover, this communication method will be important [16]. Further, in other living things, it is often done to specify actions in the form of cautionary or guidance by pheromones [17]. Especially, in humans, interaction and cooperation with the surroundings are doing unconsciously within this atmosphere and synchronization [10, 16]. If a robot working in a dynamic environment, such as daily life, will be implemented, these information methods, its will be perform actions and tasks with higher affinity with humans will be predicted.

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