Design and Development of IoT-Based Pet Care Robot

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A pet care robot based on the Internet of Things (IoT) that uses a variety of sensors and actuators to remotely monitor and care for pets is presented in this paper. The robot is made to give pet owners an automated way to make sure their pets are healthy, safe, and comfortable. A mobile robot with a camera, microphone, temperature sensor, and motion sensor makes up the system. This allows the robot to interact with pets and collect data in real time. After that, the collected data are sent to, where they are analyzed and processed to produce useful insights and alerts. Additionally, the pet care robot has a feeding system that distributes food at predetermined intervals to ensure that the pet receives adequate nutrition even when the owner is not present. The proposed system is affordable, simple to use, and adaptable to various pet requirements. The aftereffects of the review exhibit the viability of the IoT-based pet consideration robot in observing and dealing with pets, in this way upgrading the prosperity of pets and diminishing the responsibility of animal people.

Keywords: IOT Based Robot, Pan-tilt assembly, Dispenser system, Mobility of the robot, Web page controlling.

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1 Introduction

In the field of pet care, the applications of robotics and the Internet of Things (IOT) technology has been gaining traction. The need for automated solutions to ensure pets' health, safety and comfort while their owners are away has grown in importance as the number of pet owners grows [1]. A promising solution has emerged in the form of IoT-based pet care systems that make use of sensors actuators, and cloud computing to remotely monitor and interact with pets [2]. The IoT-based pet care robot is a cutting-edge technology that provides pet owners with an automated pet care robot that can interact with pets and collect data in real-time thanks to a variety of sensors and actuators After that, the data are sent to a platform in the cloud for analysis and processing, which results in useful insights and alerts for pet care [3]. The pet consideration robot likewise includes mechanized taking care of framework that apportions food at explicit stretches, guaranteeing that pets are very much taken care of in any event when proprietors are away [4]. This paper highlights the advantages of the IoT-based pet care robot, including enhanced interaction between pet owners and improved pet health Overall, the IoT-based pet care robot has the potential to change the pet care industry by offering pet owners a low cost, user-friendly, and customizable way to ensure their pets 'well-being [5]. Customers are interested in automatic devices for the purpose of ease of use and time savings, and businesses are attempting to meet the demand. As a result, the automation industry is becoming stronger and more developed every day [6]. Automation is a method of controlling and operating procedures in an automatic manner with the assistance of electronics and software that will be programmed and implemented with machine learning technologies. Automation is not very new; it has been present in the market since the introduction of the first ATM machine in the 1960s. With the assistance of such machinery, the process became People love their pets, but there are times when you want to leave them alone for long periods of time, and this is often a problem [7]. A doggy day care robot that keeps an eye on and feeds the dogs or cats in an extremely timely manner is what we propose here. Our project is an Internet of Things-based automatic pet feeding and monitoring system. The reason this was chosen as the title is to initially give up on finding a solution to a problem that many of us who keep pets face. It is difficult for humans to interfere with taking care of pets when they are busy.As a result, our system is effective enough to overcome the challenges that humans face when taking care of pets. This pet care system could be a complete apparatus for controlling the pet's freedom and monitoring all activities, especially those of a dog. Moreover, the venture is partitioned into a few modules, each with a special component. The system can feed the animals, keep track of their movements, and inform the owner of any changes. Many people find it difficult to feed their pets in a responsible and intelligent way [8].the matter ends up being particularly clear when the proprietors have an intensely involved individual life. Owners will fill the feeder before leaving if they don't have time to feed them on time. His or her pets will almost always develop pathological conditions as a result of their unhealthy diet. According to recent research, obesity, and overeating are among the top health issues. Younger pets may continue to eat until there is nothing left to eat [9]. Indeed, even grown-up pets can have an indistinguishable propensity, which causes a way more limited life expectancy for the pets. Our project is an Internet of Things-based automatic pet feeding and monitoring system [10]. It is difficult for humans to interfere with taking care of pets when they are busy.

2 Methodology, Circuit Designing and Prototype

This chapter explains the step-by-step process starting from design to the Prototype of the project refer Figure 1

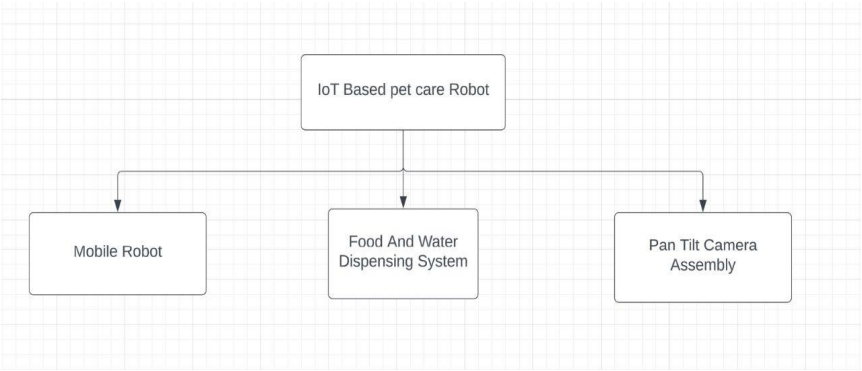

Figure 1. This picture shows the process of the robot works.

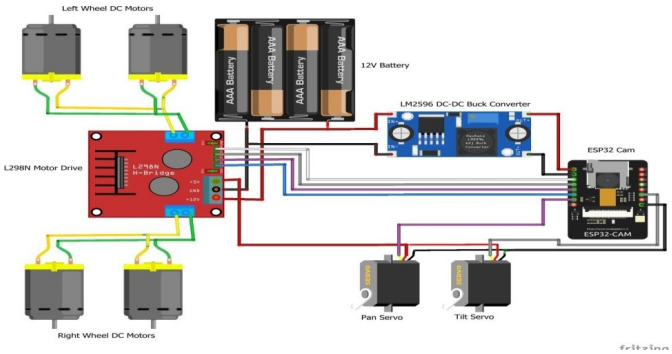

Figure 2. circuit design for the robot mobility and for the camera movement to monitor the pet with the help of the camera and as well as we can control the robot like a R.C vehicle.

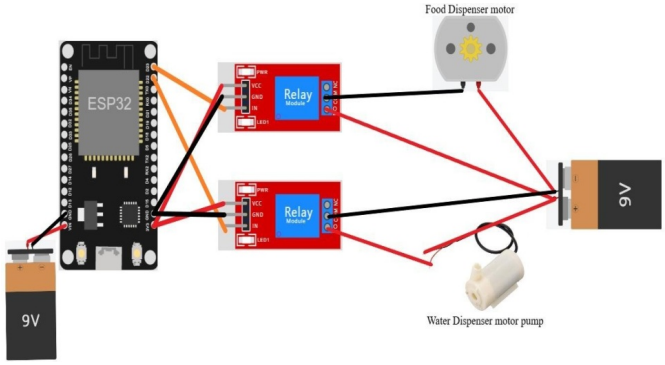

Figure 3. circuit design of the food dispenser system. We can dispense the food into the container with the help of ESP32 module and a relay system is used for the food dispenser system we used a 45RPM DC motor to dispense the food and for the water we used the basic water pump to dispense the water into the container were both the containers are fixed on the robot.

2.1 Prototype Design

Acrylic sheet was used for the frame structure because of its availability in the market and because it is cost efficient. The frame was laser cut ted together according to the dimensions done in solid works. Motor housing was done with the help of basic mechanical machinery such as a lathe and drilling machine. The center was taken and the hole was done with a depth of 5 mm and diameter of 32 mm, drilling was done inside the counter bore to fix and screw the motor in it. Banner glue was used on the top of the housing for attaching it to the acrylic sheet. For the food dispenser we have used the L-bend PVC pipe the diameter of the PVC pipe matched with the propeller diameter, and the food container is kept above the L-bend PVC pipe. A dropper is kept inside the food container which directs the food to the propeller. The Propeller is attached to a 45 RPM geared motor which turns the propeller to dispense the food refer to Figure 2. For the water dispenser small water pump motor is kept inside the water container to dispense water refer to Figure 3. For the pan-tilt camera assembly servo case and esp32 camera, the case had been 3D printed and kept on the upper plate of the robot.

3 Software Used

3.1 Solid Works

SolidWorks is a 3D CAD (computer-aided design) software used in product design, architecture, engineering, and other fields. Dassault Systèmes was the company that developed it, and it debuted in 1995
[11]. For designing 3D models of parts and assemblies, SolidWorks provides a user-friendly interface that enables users to create intricate geometries and carry out in-depth simulations refer to Figure 4. The parametric modeling capabilities of SolidWorks make it possible for users to create parts and assemblies with defined dimensions and relationships between components. This empowers simple adjustment of plans as changes can be made to the elements of one part, and the whole model will refresh in like manner[12]. SolidWorks likewise incorporates a scope of devices for performing reproductions and investigation of plans, like pressure examination, movement reenactment, and liquid elements recreation. Before making physical prototypes, engineers can test their designs virtually and improve their performance, saving time and money[13]. One more significant element of SolidWorks is its capacity to produce 2D designing drawings from 3D models. Dimensions, tolerances, and other annotations can be added to these drawings to meet industry standards [14]. Using tools like version control and document management, SolidWorks also gives teams a place to work together on designs at the same time. Other software tools, such as CAM (computer-aided manufacturing) and PLM (product lifecycle management) systems, can also be integrated with it[15].

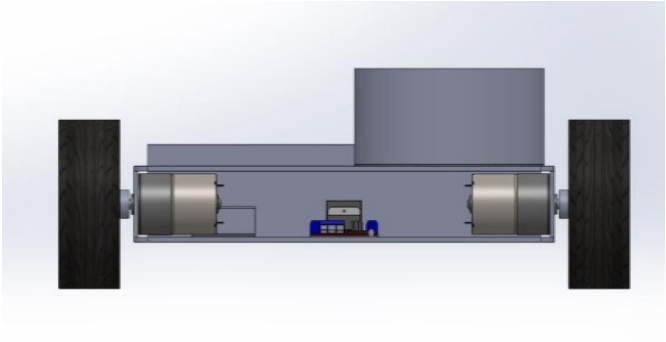

Figure 4. Side view of the robot.

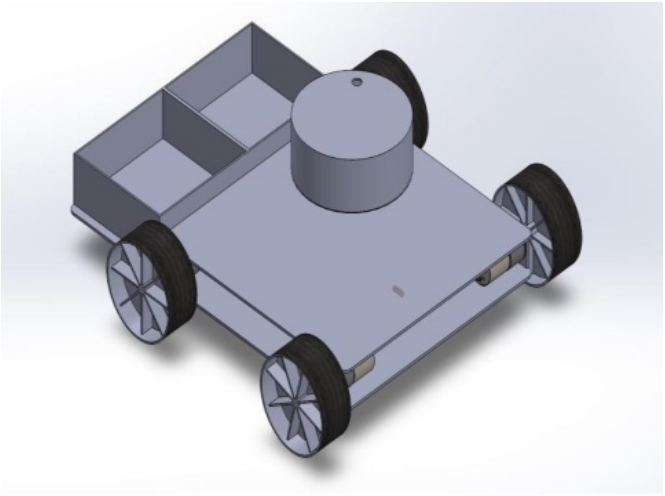

Figure 5. Isometric view of the robot

As we designed the robot using solid works software to get the perfect design of the robot as well as the accuracy of the robot as we can cut the material as per the dimensions and we can have a perfect shape of the working model for this only reason we used the solid works [16].

3.2 Web-Page Development using HTML

We designed a web page to control the robot with the help of our mobile and with the help of the WIFI we can control the robot by seeing through the camera which had been installed on the top of the robot [17], as we can control the locomotion of the robot and we can dispense the food with the help of google assistance also which had been created with the help of sinric pro software [18].(see Figure 6)

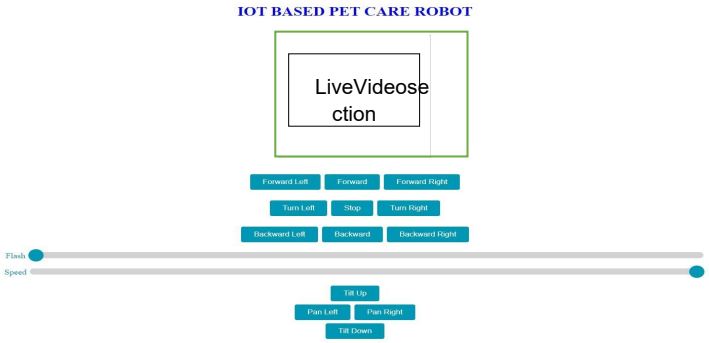

Figure 6. we developed the web page to control the robot via using HTML code to run the robot with the help of the WIFI module as we can dispense the food by this website, monitor the robot, we can control the speed of the robot.

4 Result And Discussion

In this chapter, we are going to see how the dispenser system works.

An application called sinric pro provides free IOT services. It allows to use of up to three devices connected to the application. The application is connected to the Esp32 which is used for the food and water dispenser[19]. Digital switches are created with the names of the food and water dispensers and if it is clicked the app sends the signal to the esp32 and the esp32 sends the signal to the relay channel to turn on and turn off. The Sinric Pro app refer to Figure 7 can also be interfaced with the Google Home application so digital switches will also be displayed and controlled in the Google Home application[20]. As the Google Home application can also be used to control the dispenser, now the dispenser can be controlled via the Google assistants via voice. (see Figure 8)

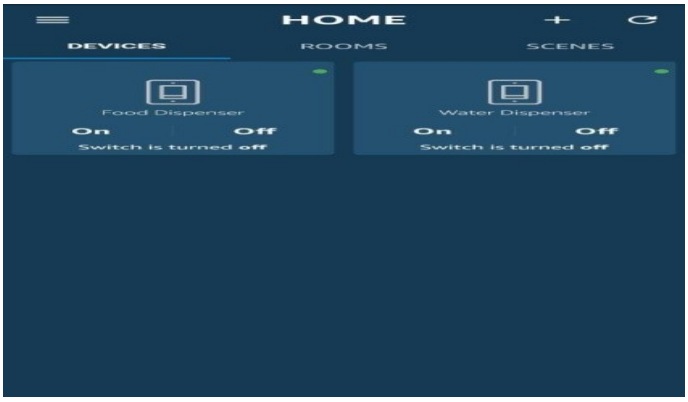

Figure 7. sinric pro application were we connected our robot to control the food dispenser system to control voice recognition.

Figure 8. Notifications from the sinric pro application during the process of the food dispenser system.

4.1 Final Model of the Robot

Below mentioned figures are done and fabricated with the help of acrylic sheet, we 3d printed the food dispensing system, camera frame, and wheels with the perfect dimensions of those systems. As we trimmed the acrylic sheet with the help of a laser cutting machine with perfect dimensions we can go around and we can see the perfect dimensions refer to figure 9.

Figure 9. Fabricated view of the robot as above mentioned this is the prototype of the pet care robot this is the final model of the robot can control the robot with the help of the WIFI module can control the robot from were ever we want.

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