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Autonomous Theft Proof Delivery Robot for Food & Ecommerce

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***Abstract**: Due to the pandemic situation around the entire world, safe and contactless delivery services have become convenience for the people while they are forced to stay in far distance. In these , we have suggested a prototype robot for food delivery that can be very convenient to reduce the risk and infection of disease in the food delivery robot System during the entire process of food delivery on healthcare and hygiene and contactless in these pandemic time. The design and development of a cost-effective Autonomous Theft Proof Delivery Robot for Food & prototype have been presented that can deliver packages safely to a destination using (GPS) system with safety and hygiene. The robot ensures a secure and human-contactless delivery by using a protected container to carry the delivery package. Package (food) deliveries are effectively growing at a fast and many start-ups have already food deliver and groceries to consumers through Autonomous Food Delivery Robots (ADR). Our research suggested this problem and robot delivery concept in which both robots and the delivery visit customers.*
***Keyword**: Last mile[1], delivery robot, travel energy, customer safety*

I. Introduction:

This is the generation of robotics and automation, more over COVID pandemic has increased the need for far distance. So, to food deliveries without the spread of infections and decease due to human contact and other factor we here propose an autonomous food delivery robot system. In this research the technology of delivery Robots is under the operations' perspective. Their application inserts in a complicated context in which a growing emerging awareness of a need of improvement of urban mobility is forcing companies to think to smarter and greener ways to complete deliveries. Autonomous Food Delivery Robots are in the important part (heart) of many themes concerning environmental feasible, operational performance, urban mobility, AI and regulations which point out the complexity and problem and importance.

The Autonomous Theft Robots Market snapshot was valued at USD by year 2020 was 0.37 million, and it is expected to reach a value of 3.72 million by year 2026, at a CAEGR of 49.01% over the period 2021-2026 year.

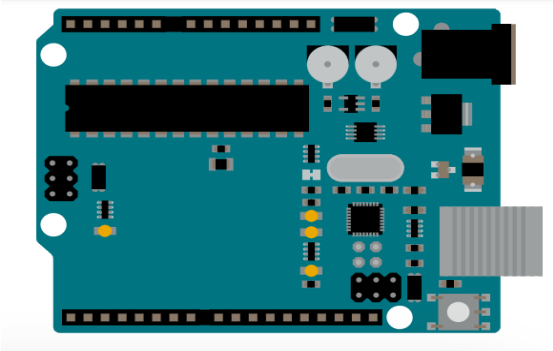
The autonomous theft food delivery robots (AT-FDR) is expected to the last mile delivery systems, providing a contactless affordable and effective way of food delivery.

Food delivery robots have not had high acceptations, they are expected to have high growth in the market, winning to various benefits.

Technical Architecture

A. Components

1) Arduino MEGA 2560 : The MEGA 2560 is designed for more complex projects This gives your projects plenty of room and opportunities



2) Dc Motor: A DC motor is an electron mechanical energy conversion device, which converts electrical energy input into the mechanical energy output.. Each type of motor is used for different purpose.

3) Buzzers: We have used a buzzer (Pier speaker) to indicate a wrong password by generating a beeping tone.

4) RF Receiver: RF Receiver signals running in the receiver transmitter. RF Receiver operates at a frequency of 433MHz this is specific . As compared to the other devices(frequency device), the performance of an RF Receiver will depend on many factors like by increasing the power a large communication distance will be gathered.
The RF recivers modules are very small in dimension and have a wide operating voltage range i.e. 3V to 12V.

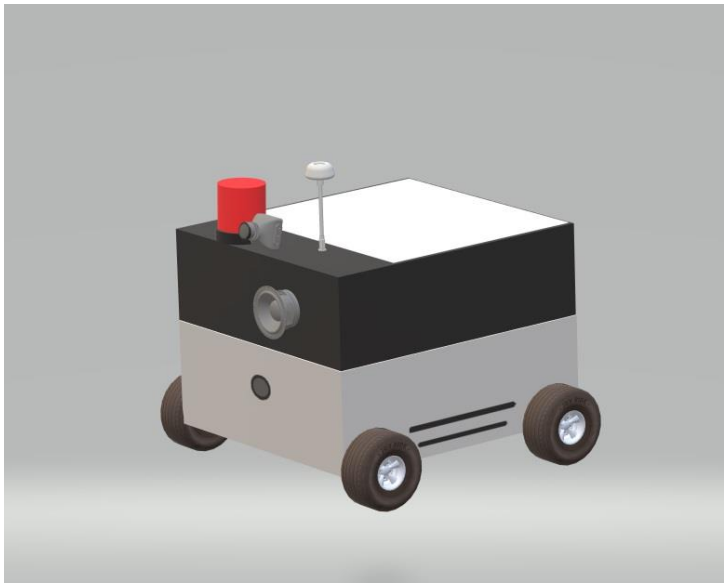
5) Siren: A siren device is a loud sound -making device. Defence sirens device are mounted in locations and used to warn of natural disasters or attacks or any problem . Many sirens device "used for calling the volunteer fire-fighters" serve duty as defence sirens device .

6)Lithium Batteries: Batteries are also called as lithium-metal batteries. Depending on the compounds and design used, Lithium Batteries cells can produce voltages from 1.6 V (voltage) to about 3.6 V(voltage).
7) Resistors: The Resistor is defined as The main purpose of resistor is to reduce the current flow and to lower the voltage in any particular portion of the circuit. Resistor is made of copper wires, coiled around a ceramic rod and the outer part of the resistor is coated around with an insulating paint.

7) Capacitors: A capacitor is a device . It stores electric charge and consists of two plates(conductive) separated by an *dielectric* or *insulator* . The charge is stored on the inside of the conductive plates, at the boundary with the dielectric.
The capacitor's capacitance (C) = voltage (V) appears across the plates with charge .
← C = Q / V →

Solution Implementation for The project: The Autonomous Robot is designed with Arduino Mega to ensure the complete project working. The robot is consisting a 4-wheel drive and remotely controlled by an RF remote with mobile.
Also the boot tool has a section to carry item on it which can be opened only by the customer. This Autonomous Theft Proof Delivery Robot project eliminates the problem of any other issue and ensure human delivery with contactless.
Also, the autonomous theft robot is consists with a sensor to avoid contact into people or objects and surroundings.
The Monitor Team the autonomous theft robot direction by a remote to easily navigate the robot direction.

The robot consists of a buzzer (for sound system) to connect with customers and make an alarm to notify them to open the door when boot arrives. Also, the sound system is used to make alarm if an any other person who are not customer those who attempt is made along with an alarm system. The boot is able to deliver food and packages up to 10 kg using its powerful 4 wheel DC motor drive system.
The sensors control robot with long range camera allow it to deliver as well as any theft attempts using the on board siren system.



II. METHODOLOGY

On the other hand, approach is an exact procedure for a thing to do that is shaped under essential principles and rules. Due to these definitions, approach insinuates the procedure utilized in an audit. The electronic food mentioning system and the purchaser self-mentioning structure were made including a fountain perspective as a part of the item headway life cycle (SDLC). System engineers use it to make or change information structures or programming. It isolates the improvement cycle into stages or methods. It will typically happen to a more elevated level ensuing to completing one. At the point when the continuous stage miss the mark, it is generally speaking vital for return to a chance to start.

The efficiency of SADRs will be inspected utilizing relentless approximations. The documentation used is summarized underneath.

n = Number of clients served
$l(n)$ = Ordinary distance a vehicle goes to serve n clients
kl = Coordinating limit tending to non-Euclidean travel on walkways and roads
ψ = Covering factor among SADR organization districts
a = Area of organization district where n clients live
m = Number of van visits essential to serve n clients
d = Distance between the station and the numerical focal point of the assistance area
r = Scope of the assistance area
τ = Outright van time essential to make n transports
s = Ordinary speed of the vehicle
$t0$ = Time it takes to believe that the client will get their solicitation from the vehicle
tu = Time it accepts the vehicle as well as driver to exhaust the movement

While contemplating how to gauge the efficiency of a SADR, or any transportation vehicle, one of the fundamental numbers to consider is the finished distance the vehicle needs to branch out to make a movement, then again various transports. The regular distance $l(n)$ can be surveyed as a component of client thickness, number of vehicles, network ascribes and course limit coefficients, and the distance between the station and the movement district (21). The condition used in this paper to discover the distance made an outing to visit n clients is:

$$l(n) = 2md + kl\sqrt{an} \quad (1)$$

In condition (1), d addresses the average division from the distribution center or scattering centre to the customer(s) copied by two, the times the vehicle goes to and from the organization or movement area (SA); kl is a predictable worth tending to coordinating limits in the SA. The assistance district where clients are found is tended to by a. The amount of clients or stops is tended to by n. For straightforwardness of documentation and assessments, an indirect SADR organization area is acknowledged at this point the system depicted consequently can be used with other SA shapes. As metropolitan regions are generally rectangular instead of round, the kl 23 guiding prerequisite reliable adjusts to this and it is acknowledged a Manhattan or L2 standard (21). Taking condition (1) and handling for a results in a recipe that can be used to choose the run of the mill area a SADR could cover given the best l(n) (vehicle range) is known. Tolerating a round help locale, the reach r of the SA that a vehicle (or SADR) could serve from the point of convergence of the SA is tracked down utilizing condition (2).

$r = \sqrt{(l(n)-2md)}\ kl\ 2\pi n$

Whenever the DC is arranged in the point of convergence of the SA, and there is no extended length distance (d=0), the past circumstances can be improved. Another critical number to contemplate while overseeing last mile movements is the time it takes to make n movements. A recipe to discover the course range time accounting not simply for driving time yet also keeping it together for the client and exhausting the bundles is the going with

$\tau = 1s\ (l(n)) + (t0 + tu)n$ (3)

The underlying term of condition (3) addresses the driving time and the second term of the circumstance addresses the time it takes to stop, hold on for the client, and void the groups. To evaluate the amount of SADRs that are critical to cover a district we utilize the result shown by Kershner (23) that showed that the base number of circles to cover a district is approximated by: Jennings, Figliozzi

$\psi\ a$

$\pi\ (r)$

where r is the size of the circle that can be covered by a SADR and ψ is a part that records for the get over among indirect SADRs organization locales. We expect a low worth of ψ = 1.21. Finally, it is acknowledged for the circumstance study (next region) that SADRs are used enhancing mother ship vans for instance, the one showed in (Figure 1) underneath. Note that the articulations "mother ship van" and "SADR van" have a comparable importance in this investigation.

A . Standard Van Results

We will now examine how many customers a standard van without SADRs can serve in an 8 or 10 10-hour shift. It is assumed the same SA radius of 2.97 miles (4.78 km) and same travel speeds 11 s = 17.5 mph (28.2 kph). In addition, it is assumed that the driver has to wait an average of $t0$ + 12 tu = 10 minutes per customer. This results in the same amount of time $t0 + tu$ = 10 used for 13 the SADR van to park, load a SADR with its delivery items and send the SADR out of the van 14 (equal times allows for an easier initial comparison). 15 The SADR-van can serve 48 customers in less than half the time, see for example Table 4 16 and the row where d = 10 miles. Table 4 indicates that there is clear increase in productivity 17 when a van is complemented by SADRs. The faster delivery time is a bonus as companies are 18 moving to shorter delivery periods, for example Amazon has recently expanded its one-day and 19 same day (two-hour) delivery services (25). 20 However, the time per delivery $t0 + tu$ can be substantially shorter than 10 minutes per 21 customer. For example, a typical UPS delivery truck in a dense urban area can deliver 200–300 22 pieces and packages and serve on average n = 120 customers (26). Decreasing $t0 + tu$ to 5 and 3 23 minutes produce the following results

B .Size and Weight Limits

Washington DC and Florida have dumped weight cutoff points of 50 pounds. The 50-pound limit confines SADR organizations, as numerous SADRs weigh in excess of 50 pounds. Starship Technologies' SADR weighs 40 pounds dumped, which furnishes an upper hand in areas with low weight limit . Different places like Wisconsin, Ohio, and Idaho have less severe guidelines, with dumped weight cutoff points of 80 to 90 pounds. At last, there are different spots where weight restrictions permit basically all SADRs right now available. These incorporate Utah, with a dumped 150-pound limit, Austin, Texas, with a dumped 300-pound breaking point, and Arizona and San Francisco, California, with no weight limits.

C. Speed Limits

Practically all spots have a speed limit for SADRs of 10 miles each hour, the exemption being San Francisco with a speed breaking point of 3 miles each hour.

Market survey:

* The increasing affordability and return on investment of a variety of infrastructure robots is driving the growth of ADR.

* Last time deliveries are getting more and more complex in area, as continued growth in market and high consumer expectations for deliveries for food is faster, and frequent deliveries are causing problem like traffic congestion and increased pollution.

* According to the National Retail Federation, shipping mishaps caused losses of about $333 million. Due to such issue in food delivery, various consumers have been looking for better opportunity and methods of food delivery in cities.

* Also, many consumers have realized that a superior last-time experience engages and retains consumers However, meeting customers' expectations of timely deliveries doesn't help increase profits margins, as today's retailers are absorbing a part of the cost of last-mile delivery.

* Therefore, Autonomous food delivery robot is benefits these consumers in achieving effective last-mile food delivery in cities. It is expected that, by 2024, 80% of last-mile food deliveries will mainly be done using autonomous robot.

* Various laws are being put into place to control global warming, and these laws are likely to help the growth of ADR's. European Country (EC) has set an objective of decarburization by 2040, with a few immediate goals in 2020 and 2030. A general shift has been ongoing toward autonomous food delivery robot systems. Companies, such as Google, had partnered with User for providing one-day deliveries to their subscribers.

* Most of the market vendors are betting that restaurants and grocery stores will increase their reliance on convenient digital technologies to meet consumers' changing needs. Many companies are investing in the growth of delivery robots.

* With the outbreak of COVID-19, the demand for contactless delivery has expanded exponentially, where many autonomous delivery robot companies are seeing a massive opportunity to grow amid the corona virus outbreak that has millions of people staying home.

In March 2020, New York Style Pizza in Phoenix, Arizona, is delivering the pies by first sanitizing the inside and outside a Star ship robot and placing the robot inside. The robot can travel to nearby customers and navigate in snowy conditions.

* However, the uncertainty of the market recovery time after the pandemic, the economic impact for some parts of the world is expected to create serious problems for the growth of the semiconductor market, directly affecting and the availability of key raw materials needed for the production of stand-alone devices. delivery robots around the world.

III. Conclusion

The improvement of online food mentioning system included many stages. The system used is a various levelled one concentrating on what first, then how and moving to moderate levels of details. In the course of this survey, various issues were found to have demolished the ampleness of the existing manual structure. These issues, information necessities and activities were filed and later used as the basis for system plan, which expeditiously followed the principal stage. The arrangement stage was concerned basically with the assurance of the system parts in way that best met the affiliation's business needs.

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