Title

An Artificial Intelligence analytic based Laser Beam Bird Repellent System for Indoor use

Field of the Invention

This invention relates generally to a Pest Repellent system. In particular, this invention relates to a Pest Repellent system solely for Indoor use to provide an indoor area from Birds against roosting, food scavenging and posing a hygiene risk to humans.

Background

The conventional Canteen, Cafeteria, Eateries, Market places, etc are indoor structures for humans to congregate to store, purchase, procure cooked food, uncooked food and food waste; these usually becomes a source of attraction for pests such as birds, rodents, etc to either nest, seek shelter or scavenging, and they will bring along a hygiene risk to food safety.

There are no known effective means of deterring pests from indoor structures. Pests (primarily birds such as mynah, pigeons, crows, seagulls, etc) may be fearless of humans and work collectively to ensure no harm comes to them during scavenging. The teamwork[1] among birds requires one bird to be perch at high ground acting as a scout for the area of preying, who will direct other scavenging birds to the food when it is left unattended. This task is rotated until all birds have eaten their fills.

The solution to this indoor pest problem has been human intervention is usually the sole method in deterring pests but usually happens after the food or food waste has already been attacked by the pest. Mitigation of food leftover through regular table cleaning to unmanned disposal centers helps to reduce pest infestation but is not efficacious.

Alternative unconventional method such as anti-bird spikes r anti bird netting placed on steel girders, top of walls is passive Repellent method which prevent pest from reaching out to the high places to stake out or await their opportunity to scavenge. Pest usually adapt to their presence by avoiding these apparatuses and are able to continue their scavenging, nesting or sheltering actions. Where pests have been unfortunate to be caught in such spikes and anti-bird netting, their carcass may decompose and create health hazards. The use of these passive apparatus is a bane to the finished architectural form and structure.

Thus, a need clearly exists for an active yet non-invasive system that considers and retain the form and purpose of the structure, to be able to inject as measured repellent response that instil a sense of fear into the birds, to upset them, to cause them to be unable to scavenge for food nor roost within the structure and in doing so, in a humane way that does not harm them nor causing harm to human.

Accordingly, this invention seeks to provide Such a smart apparatus is self-contained inside an enclosure that is durable and dust-free, able to detect, identify humans from birds using Artificial Intelligence analytic, take constructive active action to deter pests (primarily birds) from the area of protection without the need for human intervention, whereby the above problems are able to duly ameliorated.

[1] https://en.wikipedia.org/wiki/Javan_myna

Brief Description

1) In accordance with a first aspect of this invention, there is provided an external frame in the form of a dust-free, non-metallic construction and having at least the following elements forming a popsicle shape apparatus; a first member being a turret base and a second member being the turret of equal halves forming a capsule body and a third member being support stem connecting both halves to the structure which the self-contained apparatus is suspended.

2) The first half capsule member shall have a protruded sill that extends beyond the cylindrical edge of the second half capsule members, providing immediate cover against dust from entering the apparatus.

3) The construction of the support stem consist of a flat plate is welded to one end of steel stem made of round hollow section with the other end threaded for a distance of 30-50mm. Apertures are preferably formed on the steel stem, one above the capsule and one or more inside the turret base along the same generatrix as the former; these machined apertures permit the entry of cables from the components inside the capsule to be connected to an external control panel. The flat plate allows the stem to be held and anchored against the structure without any form of welding which may damage the existing steel member and to be adjusted accordingly for true level and plumb.

4) A EPDM grommet is laid over the oculus over the dome of the turret base allow it to accept the stem which extent from the soffit of the structure penetrates into the core of the capsule pass the annulus base plate for the turret base, where it is received by sealed castor bearing and an internally threaded steel plate that will adjust the final height of the capsule and carry the entire weight of the capsule with the balancing of the turret base on other parts of the annulus support plate by crossed roller skewing bearing with inward facing gears attached to the perimeter of the plate.

5) Also, on the external body of the turret base, a number of apertures are preferably formed to allow the fixing of devices with indicating, controlling or sensory function relating to the external parameters. A clear acrylic cover is applied over the opening located in front of the apparatus for the operation of the CCTV camera and when removed allow the camera to be extracted and replaced during maintenance.

6) On the external body of the turret, is a narrow, vertical embrasure is formed at the front of the turret body along with an opening for bottom dish shaped access cover made of the same material as the capsule body for functional checks of components and mechanism only, which allow the entire apparatus to be laid on the ground easily.

7) Inside the turret base body, is a metallic mechanism design use for setting the azimuth of the upper level laser guns to math upper space over the area of coverage. The gear that determines the angle of tiltation to the y-axis is controlled by a removable lug wrench through one of the above described apertures along the same directrix of the turret body. A similar mechanical set up is avail for the IP based CCTV camera with the azimuth set at the lower space of the area of protection. A noise cancelling condensing microphone is placed inside the aperture at the front of the turret base body, with other apertures with about similar diameters are fitted with a rapid strobe indicator, “system normal” indicator and a emergency stop (kill switch) button. To remove and replace the laser gun/s, the front cover over these gun/s needs to be removed first, and the gun/s can be extracted by manually and replaced by a working piece simply through snap on contact with the neodymium magnet type power

Brief Description (cont'd)

adapter. To remove and replace the CCTV camera, the side access panel and front acrylic cover needs to be removed first, followed by disconnecting the multiple pin adapter ~~and~~

8) Inside the rotary turret body is a metallic mechanism to achieve pan-tilt function by setting the azimuth of low-level laser gun/s within the embrasure and similarly to the above-mentioned laser gun/s in the y-axis along with the horizontal rotary action.

9) The function of the condensing microphone is to capture the sounds from any bird/s inside the indoor structure where the audibility is identified from the pitch and frequency and compared against pre-trained CNN to ascertain if it is Bird/s. This function is used for high space of the area of protection where visual detection is not suitable due to the numbers of structural elements that may conceal the Bird/s from sight, that the Bird/s at this position is either roosting or scouting and not scavenging.

10) The function of the IP based fixed CCTV camera is to capture the presence of bird/s and human, particularly the latter who may be intimate with the apparatus when servicing it, may be exposed to sudden discharge of laser beams. An optional attribute is to capture the presence of fire. The operation of the CCTV camera is set at the low space of the area of protection where visual recognition is based on the entire Bird and for human, the head and top torso of the body. The data for lower torso for AI analytic is dumped to expedite the data processing time. AI analytic for both human and bird/s is based on shape and size scalability whilst the AI analytic for optional fire/ smoke detection is based on color, texture and size scalability.

11) Upon matching the audible recording against pre-trained CNN for bird sound, the upper level laser gun/s will be activated for a duration of about ten (10) seconds

12) Upon matching the video imaging of the area of protection against the pre-trained CNN for bird shape, the lower level laser gun/s will be activated for a duration of about seven (7) seconds.

13) When the laser gun/s is activated, variant attributes in context of disruptive dissonance, from time duration, intensity non- linear polarisation at plane are applied to ensure zero consistency at each beam discharge, so as to confuse the bird/s ability to adapt through cognitive learning.

14) The CCTV will continue to monitor presence of bird/s after the first discharge, and emit a second discharge after a time lapse of ten (10) seconds, and upon fourth event, an extended beam duration of about 3 minutes with maximum intensity will be applied.

15) A possible combination of laser gun/s on active duty and standby dun may be applied in the apparatus. A photo beam sensor will be placed inside the apparatus that will detector the discharged laser gun/s when it is activated and compared event.

16) In simplified form, the invention may still exist as a self-contained apparatus but the mode of operation may be attributed to 2.4GHz remote activation, controlled by smartphone application, timer activation or by localised control of momentary switch.

Brief Description (cont'd)

17) In further simplified form, the self-contained apparatus may not require CCTV camera and/ condensing microphone to operate with the above described attributes for non-automatic function/s.

Detailed Description

1. A number of preferred embodiments of the apparatus and of the method of repelling the birds inside the indoor structure are described. In the following description of the preferred embodiments, numerous details are described in order to provide a more thorough description of these embodiments. It becomes apparent to one skilled in the art, however, that the invention may be practised without such details. In other instances, well-known details have not been described at length so as not to obscure the invention.

2. The advantages of the preferred embodiments of this invention are manifold. One advantage is that nuisance posed by the Birds and the associated health risk can be mitigated, through repelling the birds using low powered laser beams and is done in a humane way without injuring or culling them. Another advantage is that invention takes further steps to prevent Birds from adaptive learning through cognitive behaviour of a robotic, fixed action by the apparatus. This invention is particularly advantageous for open food courts, hawker centers and wholesale market. Another advantage of the embodiment of this invention is that cleaners are more likely to buy and use this implement to clean windows if it is relatively simple, lightweight and safe.

3. Referring to the above, the area of protection is defined as a structure with an indoor space which harbours human from the weather elements and provide food attraction to the pests. The space may or may not be enclosed along its sides where pest infestation or ingress cannot be adequately or effectively prevented from entering it for purpose of roosting or food scavenging.

4. Referring now to Figure 1 and Figure 3, there is illustrated a first preferred embodiment of the apparatus A01 which is the aesthetic aspect and external functions of the said apparatus and a method for repelling birds from area of protection in accordance with this invention.

   The external frame of the popsicle shaped apparatus, capsule size approximately 400mm diameter, 750mm high shall be manufactured in a non-metallic construction preferably in fibreglass material or plastic polymer using 3D printer, comprises of no less than A02 first half capsule member which has a A10 protruded sill that extends beyond the cylindrical edge of the second half A03 capsule members, that is intended to protect the components inside this enclosure from dust, pests and unauthorised entry, from infiltrating/ accessing the apparatus.

   The construction of the A04 support stem consist of a A05 flat plate is welded to one end of steel stem made of round hollow section with the other end threaded for a distance of 30-50mm. The apparatus shall have static mounting, be suspended at a height of 3m or higher (measure from finished floor level) in a fixed, pre-defined location based on the spatial limitation of the software radial coverage over the area of protection.

Detailed Description (cont'd)

Apertures are preferably formed on the A04 steel stem, one or more A07, A08 above the capsule and one A09 inside the turret base along the same generatrix as the former; these machined apertures permit the entry of cables from the components inside the capsule to be connected to an external control panel. The A05 flat plate allows the stem to be held and anchored against the structure without any form of welding which may damage the existing steel member and to be adjusted accordingly for true level and plumb.

5. Included in the first embodiment is an A30 EPDM grommet with inner diameter of about 50mm is laid over the oculus over the dome of the A02 turret base allow it to accept the stem which extent from the soffit of the structure penetrates into the core of the capsule pass the A31 annulus base plate for the turret base, where it is received by A32 sealed castor bearing and an A33 internally threaded steel plate that will adjust the final height of the capsule and carry the entire weight of the capsule with the balancing of the turret base on other parts of the annulus support plate by A25 crossed roller skewing bearing with inward facing gears attached to the perimeter of the A31 annulus base plate.

6. Also included in the first embodiment and on the external body of the A02 turret base, a number of apertures are preferably formed to allow the fixing of devices with A19 indicating, A18 controlling or A20 sensory function relating to the external parameters. A13 a clear acrylic cover clear approximate size 200mm x 120mm high, is applied over the opening located in front of the apparatus for the operation of the A27 Fixed IP CCTV camera and when removed allow the camera to be extracted and replaced during maintenance.

7. Included in the first embodiment and on the external body of the A03 turret, is a A14 narrow, vertical embrasure 25mm wide x 200mm long is formed at the front of the turret body along with an approximately 250mm diameter opening for A15 bottom dish shaped access cover made of the same material as the capsule body for functional checks of components and mechanism only, which allow the entire apparatus to be laid on the ground easily.

8. Referring now to Figure 2, Figure 4, Figure 5 and Figure 6, there is illustrated a second preferred embodiment of the apparatus A01 which is the functional and operational aspect of the apparatus and inside the turret base body, is A21 a mechanical set up use for setting the azimuth of the A20 upper level laser guns to math upper space over the area of coverage.

The gear that determines the angle of tiltation to the y-axis is controlled by a removable lug wrench through one of the above described apertures along the same directrix of the turret body. To remove and replace the A20 laser gun/s, the A11 front cover over these A20 gun/s needs to be removed first, and the A20 gun/s can be extracted by manually and replaced by a working piece simply through Snap-On magnetic contact with the A34 neodymium magnet type power adapter.

Included in the second preferred embodiment and on inside the turret base is a similar A32 mechanical set up adapter base is avail for the A27 IP based CCTV camera with the azimuth set at the lower space of the area of protection. To remove and replace the A27 IP based CCTV camera, the A17 side access panel and A13 front acrylic cover needs to be removed first, followed by disconnecting the A34 multiple pin adapter and releasing the A27 IP based CCTV camera from the A32 adapter base.

Detailed Description (cont'd)

9. Referring now to Figure 1, Figure 2 and Figure 5, there is illustrated a third preferred embodiment of the apparatus A01 inside the turret base, an audible detection via A13 a noise cancelling condensing microphone is placed inside the aperture located at the front of the turret base body.

10. Referring now to Figure 1, Figure 2 and Figure 5, there is illustrated a fourth preferred embodiment of the apparatus A1 inside the turret base, a video detection via a A27 IP based self-contained CCTV camera that is capable of supporting AI analytic with built in function via Random Access Modules and / Read Only Modules for Coding and image processing.

    Included in the fourth preferred embodiment is an AI analytic function to detect fire and/ smoke.

11. Referring now to Figure 1, Figure 2 and Figure 5, there is illustrated a fifth preferred embodiment of the apparatus A01 inside the turret base, A19 a rapid strobe indicator, A33 "system normal" indicator and A18 a emergency stop (kill switch) button. To remove and replace these buttons, the A17 side access panel is removed, follow by the lock nut, and the switch is removed and replaced and the respective switch is then fixed back into position by the lock nut.

12. Referring now to Figure 2, Figure 4 and Figure 6, there is illustrated a sixth preferred embodiment of the apparatus A01 and on inside the rotary A03 turret body is A35 a mechanical set up to achieve pan-tilt function by setting the azimuth of A16 low-level laser gun/s within the A14 embrasure and similarly to the above-mentioned A16 laser gun/s in the y-axis along with the horizontal rotary action.

13. Referring now to Figure 17, there is illustrated a seventh preferred embodiment of the apparatus A01 is a separate local motor control panel (LMCP) which may be mounted out of reach of most human suspended from the structure.

    The control panel shall consist of miniaturised circuit breaker for incoming power supplies and a step-down transformer cum trickle charger reducing incoming power to 12 Volt direct current, sealed lead acid battery, indicator lights, test switches, Fault/Normal/ Charger fail/ Fire (optional) LED indicators, scrolling LCD display and a master controller card, which comprise of a voltage modulator, E^2PROM module which is embedded with faster R-CNN coding, ramdrive and a removable solid state hardisk, SIM based wireless router.

    Whereas the LMCP may have all of the above attribute, an additional self-diagnostic function shall be incorporated to ensure system initialization checks are routinely conducted and fault reporting is made.

    Whereas the step-down transformer cum trickle charger, cabling, etc may be required to serve more than one (1) apparatus A01 at any one time, the CPU shall be coded such it is capable of establishing an address for each apparatus served, carry out the abovementioned diagnostic and fault reporting.

Detailed Description (cont'd)

14. Referring now to above, there is illustrated a eighth preferred embodiment of the apparatus A01, an AI analytic software designed to work with the A13 condensing microphone to capture the sounds from any bird/s inside the indoor structure where the audibility is identified from the pitch and frequency and compared against pre-trained CNN to ascertain if it is Bird/s. This function is used for high space of the area of protection where visual detection is not suitable due to the numbers of structural elements that may conceal the Bird/s from sight, that the Bird/s at this position is either roosting or scouting and not scavenging.

    Included in the eighth embodiment and the function of the A27 IP based fixed CCTV camera is to capture the image of bird/s and human, particularly the latter who may be intimate with the apparatus when servicing it, may be exposed to sudden discharge of laser beams. The operation of the CCTV camera is set at the low space of the area of protection where visual recognition is based on the entire Bird and for human, the head and top torso of the body. The data for lower torso for AI analytic is dumped to expedite the data processing time. AI analytic for both human and bird/s is based on shape and size scalability.

    An optional attribute of the AI analytic software is to capture the presence of fire/ smoke where the AI analytic for optional fire/ smoke detection is based on colour, texture and size scalability.

    Upon matching the fire/ smoke algorithm, the CPU shall send out a signal output to the electrical connector which can be connected to a visual/ audible alarm.

15. Referring to the above, the pre-trained CNN is an initial setup involves several inputs of an empty interior with no human or pest to form the bounding box for analysis and forming the backdrop of pre-trained CNN. For video recognition, pooling images will be constantly introduced and regional proposal for the established background are parsed to establish the classifier which is based on shape and size for both human and birds.

    For audible recognition, the background noise is parsed against the frequency and pitch emitted by selected birds for classifier matching. For optional visual recognition of fire, the colour spectrum and size scalability for fire and separately texture spectrum and size scalability for smoke are used to identify their presence.

16. Referring to the above, the bounding box is defined as the virtual area that is bounded by each surveillance camera that when combined will form the area of protection. The bounding box will be parsed with the convolution layer that eventually predict the presence of the classifier which may be human or birds through visual detection.

    The regional proposal established in each bounding box per iteration shall be used to match classifier, which is an ensemble of instructions, which maps the information of each image / audible of the human and birds on the following basis.

Detailed Description (cont'd)

Classifier	Visual recognition				Audible recognition
	Colour	Size scalability	Shape	Texture	
Human	Exclude	Yes	Head and Upper torso	Exclude	
Human	Exclude	No	Head and eyes only[2]		
Bird	Optional	No	Full body	Exclude	Bird's chirping
Alternative fire	Yes	Yes, minimum of 0.75m^2	No	Optional for smoke, minimum of 2m^2	

17. Referring now to Figure 8 to Figure 15, there is illustrated a ninth preferred embodiment of the apparatus A01 where upon matching the video imaging/ audible sound of the area of protection against the pre-trained CNN for bird shape, the A16 lower level laser gun/s will be activated for a duration of about seven (7) seconds.

When the A16 or A20 laser gun/s is activated, variant attributes in context of disruptive dissonance, from time duration, intensity, non-linear polarisation at plane are applied to ensure zero consistency at each beam discharge, so as to confuse the bird/s ability to adapt through cognitive learning. As part of the attribute, the A35 vibration chipsets attached to abovementioned A16 or A20 laser gun/s are also activated simultaneously with the respective laser gun/s, as summarised in following table.

Pest repellent operation	Activation	Birds	Human away from apparatus[3]	Human intimate with apparatus[1]
Low level laser gun[4] with diffraction grating len, inside turret	Visual recognition	Activate for 7±2 seconds maximum, paused for 10 s minimum. (adjustable)	Continue to operate if no human face detected (Optical safety protection)	Disable function immediately (Optical safety protection)
High level laser gun with multiple lens, inside turret base	Audible recognition	Activate for 107±2 seconds (adjustable)	Not applicable	Disable function immediately (Optical safety protection)

[2] When human is intimate with apparatus, design to prevent optical injury from laser gun

[3] Whereas the surveillance camera discovered human face/s starring directly at the direction of the apparatus or human face in close proximity of the apparatus, the laser gun shall be disabled from functioning to prevent optical injury.

[4] Whereas the laser beam is activated on detection of birds, the beam will project onto the diffraction grating len will cause divergence net effect at the target area which embodied the entire area of protection. The projection from the laser gun shall not exceed the duration of more than five seconds at any single instance, with a lapse of another ten seconds minimum time delay between activation.

Detailed Description (cont'd)

The A17 IP based CCTV will continue to monitor presence of bird/s after the first discharge, and emit a second discharge after a time lapse of ten (10) seconds, and upon fourth event, an extended beam duration of about 3 minutes with maximum intensity will be applied.

Included in the above attributes is a possible combination of A16 laser gun/s on active duty and standby dun may be applied in the apparatus. A photo beam sensor will be placed inside the apparatus that will detector the discharged laser gun/s when it is activated and compared event.

Included in the above attributes is the key characteristics and attributes of the high powered, laser pointer (Class: 2 or lower, Beam colour: green and/ blue, Wave length: 380 Nm to 600 Nm, Power rating: ≤1 Watts) with diffraction grated lens.

Referring now to Figure 2, Figure 4 and Figure 6, there is illustrated a sixth preferred embodiment of the apparatus A01 and A21 a vibrator chip will be affixed to the laser gun to overcome the static beam projection through rapid movement that will disrupt cognitive behaviour of birds toward the apparatus as non-threat.

Option of high-powered, upper level laser gun fitted with multiple lens with beam output mounted at top of the enclosure with beams projecting laterally for a minimum coverage of 180-degree radial distribution.

Option of a secondary laser gun/s to be included in the apparatus placed parallel to the primary laser gun for the purpose of design redundancy which may be utilized when the latter is non-operational to reduce mean time between failure of the apparatus.

18. Referring now to the above, there is illustrated is a rotary function for the laser gun/s to manage protection of large area or large density of human presence who may be suffer optical injury from the laser beams, by limiting the extent of beam projection onto the target area by adjusting the spatial distance between bulb and len or len diopter value.

Whereas it is deemed projecting laser light over extended target area may have health risk concerns[5] for humans, the target area may be reduced to a portion of the area of protection of approximately $10m^2$, by adjusting the laser gun lens to reduce the beam projection area over the entire area of protection simultaneously. When the extent of beam projection is reduced, compensation for coverage is made by allowing the laser gun to be moved to target area where Bird/s was detected by A27 IP based camera. In such instance, ability of the laser light to cover the entire area of protection is managed by a pair of servo motors to direct the laser gun/s to the correct horizontal and vertical axis.

For horizontal movement, the servo motor affixed directly to inside diameter of the skew rings at the turret base is adjusted in forward/ reverse motion within a radial span not larger than the field of view of the fixed camera at the turret base, which is no larger than 40-degree angle.

[5] Use of Class 2 or lower (< 1Watt power rating) laser beams are generally deemed to be safe.

Detailed Description (cont'd)

When the horizontal axis of the turret/laser gun matches the target area, the vertical axis of the pinon mounted laser gun will be activated for vertical up-down sweep within a 30-degree angle span via another servo motor affixed directly to the vertical pinion.

The movement of either servo motors shall be powered by direct current, *intrinsically* safe low voltage, reversible through polarity switching and controlled by contact type limit switch that prevent motor overrun.

19. Referring now to Figure 16, there is illustrated a tenth preferred embodiment of the apparatus A01 where upon matching the audible recording against pre-trained CNN for bird sound, the A20 upper level laser gun/s will be activated for a duration of about ten (10) seconds

20. Referring now to Figure 2 and Figure 4, there is illustrated a eleventh preferred embodiment of the apparatus A01 which is a simplified form, the invention may still exist as a self-contained apparatus but the mode of operation may be attributed to 2.4GHz remote activation, controlled by smartphone application, timer activation or by localised control of momentary switch.

21. Referring now to Figure 2 and Figure 4, there is illustrated a twelfth preferred embodiment of the apparatus A01 which in further simplified form, the self-contained apparatus may not require CCTV camera and/ condensing microphone to operate with the above described attributes for non-automatic function/s.

22. Referring now to Figure 2 and Figure 4, there is illustrated a eleventh preferred embodiment of the apparatus A01 which in further simplified form, the self-contained apparatus may not require CCTV camera and/ condensing microphone to operate with the above described attributes for non-automatic function/s.

Brief Description of the Drawings

A preferred embodiment of this invention is described hereinafter, by way of example only, with reference to the drawings, in which:

a. Figure 1 is a front view of a AI based laser light pest repellent (L2PR) apparatus in a popsicle shape self-contained apparatus suspended from a building structure in accordance with a first embodiment of this invention;

b. Figure 2 is a section across the front view (see through) of the L2PR apparatus as shown in Figure l with second embodiment of the steel support stem and the third embodiment of functional components inside the apparatus;

c. Figure 3 is a side view of the L2PR apparatus as shown in Figure l & Figure 2;

d. Figure 4 is a section across the front view (see through) of the L2PR apparatus as shown in Figure 3 with second embodiment of the steel support stem and the third embodiment of functional components inside the apparatus; and

e. Figure 5 is a plan view of the turret base with the demonstrative angle of view of the CCTV camera and projection angle of the high-level laser gun/s.

f. Figure 6 is a plan view of the turret body with the demonstrative angle of view of the and projection angle of the low-level laser gun/s.

g. Figure 7: Section view of Area of Protection with single apparatus (Bounding Box illustrated)

h. Figure 8: Plan view of Area of Protection (Camera lined to center of Bounding Box illustrated)

i. Figure 9: Plan view of Area of Protection (Camera lined to edge of Bounding Box illustrated)

j. Figure 10: Section view of Area of Protection with two Apparatus (Bounding Box illustrated)

k. Figure 11: Plan view of Area of Protection with 2 apparatus (Bounding Box illustrated)

l. Figure 12: Section view of Area of Protection with Spot Target area (close distance illustrated)

m. Figure 13: Plan view of Area of Protection with Spot Target area (close distance target area illustrated)

n. Figure 14 Section view of Area of Protection with Spot Target area (intermediate distance illustrated)

o. Figure 15 Plan view of Area of Protection with Spot Target area (intermediate distance illustrated)

p. Figure 16 Section view of Area of Protection with Spot Target area (Yonder distance illustrated)

q. Figure 17 Plan view of Area of Protection with Spot Target area (Yonder distance illustrated)

r. Figure 18 High level laser beam projection

Claims

1. A Fully Automatic Self-contained AI based Laser Light Pest Deterrent System (L2PD) device for deterring birds from at least a portion of an object comprising of an external frame, sensory members further comprising of first member visual sensor and a second member audible sensor, AL analytic software for processing the image/ audio into visual recognition of classifier as human or bird, further comprising of deterrent members of first low level laser gun/s aimed at area below the device operable by visual recognition, and second high level laser gun/s aimed at object above the device.

2. A device according to claim 1, where the object is an indoor structure such as cafeteria, food court, food wholesaler, etc where the device is used to deter pest primarily Birds from roosting and scavenging for food.

3. A device according to claim 1, where external frame is a capsule shape body, comprising of a first member turret base dust free cover with the dome surface facing upwards, a second member inverted turret body dust free cover with the dome surface facing downwards both of which are held together by a third member steel hollow stem pierced into the apex of the dome of the turret base, is used to suspend the external frame to the indoor structure at high level at height of about 3m or higher, when measured from the floor at the edge / corner of the area of protection.

4. A device according to claim 1 where the external frame is factory finished in gloss coloured acrylic designed to be dust free, and the dome shape top of the turret base is design to prevent dust collection and landing/ roosting of any bird onto it.

5. A device according to claim 1 and 3, where the abovementioned first member steel hollow stem of 50mm diameter x minimum 1.5mm thick, is machine threaded at its lower end is used to receive a second member threaded nut/s, placed below the third member ball bearing castor to support the entire weight of the device.

6. A device according to claim 1 and 3, where the abovementioned steel stem is secured firmly to the structure with a second member base plate that allow the entire device to be adjusted to true plumb and level. The lower end of the stem shall be chamfered for electrical cable from electrical appliances inside the turret, a first member EPDM or equal prop hood grommet at about the turret base height, designed for protection of cable from electrical appliance/s inside the turret base, a second member hood EPDM / rubber grommet with steel cable conduit. The configuration of the above grommet, cable penetration or such will prevent the entry of water or small pest/s like lizard, roaches, etc from entering the steel stem.

7. A device according to claim 1 and 3, where the inverted turret has a vertical embrasure for a first member 25mm internal diameter laser gun/s at front of the turret and the said embrasure is covered with a second member 1mm thick rubber sheet stuck to the inside of the turret designed to prevent the entry of water or small pest/s like lizard, roaches, etc from entering the device through the turret.

8. A device according to claim 1 and 7, where the first member laser gun/s has the following characteristics of second Class 2 or lower, third beam colour of green and/ blue, fourth frequencies of 380 Nm to 600 Nm, fifth power rating: ≤1 Watts.

Claims (cont'd)

9. A device according to claim 1 and 3, where the turret base is fitted with openings for a first member 25mm internal diameter noise cancelling condensing microphone at front of the turret base, a second member 25mm internal diameter fast strobe light indicator, a third member 25mm diameter emergency stop button (kill switch), a fourth member overall shaped aperture with a projecting canopy fitted with a removable clear acrylic/ glass len cover (for high level laser gun/s), a fifth member rectangular aperture next to the abovementioned microphone, that is fitted with a 2mm thick removable clear acrylic/ glass len cover (for CCTV camera) and a sixth member removable fibreglass cover. A means of securing the abovementioned removable cover/s by means of fixing chrome finished nut rivet of minimum 5mm inner diameter onto the turret base to accept minimum 5mm diameter x 12mm long socket hex head screw at each corner of the said cover without the use of any silicone/ similar sealant. A means of ensuring tight fit between the surface of the turret base and the abovementioned cover using EPDM or equal gasket where configuration of the above aperture, openings, embrasure, etc will prevent the entry of small pest/s like lizard, roaches, etc from entering the device through the turret body

10. A device according to claim 1 and 3, where the turret base further comprise of the first member dust free dome cover, with larger radii skirting to provide continuous dust free cover to the turret below, a second steel base support plate, fixed to a third steel skew ring across the perimeter of the support plate, a fourth sealed for life ball bearing castor fitted to the middle of the support plate which has an inner diameter hole that is slightly larger than the abovementioned round steel hollow stem, a fifth arc shape rack with inner gear which is placed vertically, welded to a sixth bespoke pivot plate which tied to a seventh pinion used to control the angle of beam projection for the eighth laser gun/s mounted onto the abovementioned pivot plate. A ninth ring shaped holder approximately 25mm internal diameter with 3mm thick flexible rubber grommet used to provide support for the stem of the abovementioned laser gun/s which is further secured at its end by a tenth neodymium magnet type power adapter.

11. A device according to claim 1 and claim 5 where the abovementioned power adapter is secured to the pivot plate will allow for magnetic connection of the power source to the laser gun/s without the need for physical screws/ bolts and fast connection to the direct current power supplies, which when activated will project laser beams from the abovementioned laser gun/s. If the laser diopter, len, circuit or any part of the laser gun/s is faulty, it can be dismantled by pulling the entire gun/s outwards from the device without the need to remove any screw/s or bolt/s and replacing with new laser gun/s, assuming there is no serviceable parts for the laser gun/s.

12. A device according to claim 1 and 11, which is a vibration Integrated Circuit chipset affixed to the abovementioned pivot plate and is powered simultaneously with the abovementioned laser gun to cause an erratic light beam emission designed to confuse the bird of an imminent threat from an approaching predator.

13. A device according to claim 1 which is a separate Local Motor Control Panel (LMCP) that is connected to the abovementioned Device A30, comprising of a first electrical circuit breaker for incoming power supplies, to power the second step down transformer (and intelligent battery charger 110VAC/ 220VAC to 12VDC), used to operate the third Central Processing Unit (CPU), fourth 12VDC panel cooler fan, fifth LED Indicator Lights, sixth

Claims (cont'd)

key test switch, seventh three-line LCD display, eighth timer controller, ninth sealed-lead acid batteries and enclosed in tenth steel constructed enclosure.

14. A device according to claim 1 and 12, an Artificial Intelligence (AI) analytic software in the form of first faster Regional-Convolution Neutral Network (R-CNN) logic structure, will be coded and embedded into the said CPU, where second coding of linear Support Vector Machine (SVM) classifier will enable the identification of classifier like third humans (only head and top torso) and fourth birds. The classifier for both human and bird involves shape scalability and size. Where additional classifier for fire is involved, this involve size, orange/ red colour and texture (smoke).

15. A device according to claim 1 and 12, where the abovementioned AI analytic software would be programmed on site to create first pre-Trained visual bounding box which will be based on the area of protection and compared against second new images based on each iteration of frame-works per seconds (fps) for classifiers humans and/ birds.

16. A device according to claim 1 and 12, where the abovementioned AI analytic software would be programmed on site to create first pre-Trained audible bounding box which will be based on the nearby environment and compared against third new audible signals for classifier birds.

17. A device according to claim 1 and 15, where classifier Birds are visually identified by the first abovementioned CPU via the second abovementioned CCTV camera, an output supply shall be provided to the third low-level laser gun and fourth vibration chip via fifth timer controller to emit a laser light beam for a duration of about seven (7) seconds at the target area. Where the classifier Birds continue to be detected after ten (10) seconds has expired after the preceding event, a following emission of laser light beam will be made. Where the classifier Birds are no longer detected after the preceding event, the device will reset to original status.

18. A device according to claim 1 and 15, where classifier Birds are visually identified by the first abovementioned CPU via the second abovementioned CCTV camera, and third the target area represent a smaller portion of the area of portion, an output supply shall be provided to the fourth servo motors inside the device in x- axis first follow by y-axis to oscillate the orientation of the fifth low-level laser gun/s to the target area where the birds are present before the output power for laser guns/s are activated as above mentioned. Where birds are located in another target area, the output supplies to the device for the servo motors shall oscillate the said laser gun/s to the new position and activate these gun/s accordingly.

19. A device according to claim 1 and 15, where classifier Human and Birds are visually identified by the first abovementioned CPU via the second abovementioned CCTV camera, and third target area, the above laser gun/s may be activated provided any human located in the target area, especially if intimate with the device is not looking at the device and may be affected by the laser light beam, then the said laser gun/s may be automatically de-energized.

20. A device according to claim 1 and 14, where fire is detection at or around the area of protection, the first strobe light shall be activated and second output contacts (voltage free/ 12 VDC) can be sent to a third fire alarm sounder or fourth DeCentralized Alarm Monitoring Company (DECAM) via fifth SIM card module or land line.

Claims (cont'd)

21. A device according to claim 1 and 19, where first Human may be intimate with the second device but the self-disabling of laser gun/s fail to de-energized, Human has to option to activate the emergency kill switch to shut down the device entirely.

22. A device according to claim 1 and 16, where classifier Birds are visually identified by the first abovementioned CPU via the second abovementioned condensing microphone, an output power supply shall be provided to the third high-level laser gun/s for a duration of about ten (10) seconds.

23. A device according to claim 1, claim 3 and 15, where the first mounting element is a self-automated navigable machinery that travel on predefined route, the second device is installed per inverted orientation where the third turret base is below the fourth turret, and the fifth CCTV camera is re-orientated upwards. Where fire detection option is exercised, the self-preservation mode shall be activated and navigate the machinery to safety outside of the area of protection.

24. A device according to claim 1, claim 3 and claim 16, where a simplified version that is not sensitive to presence of human, the device shall be mounted mid axis of the area of protection in lieu of mounting at edge of area of protection, it shall use a first condensing microphone for detection of birds and have second low-level laser gun/s and third high-level laser gun/s. Where the audible sensors are activated, the laser gun/s at both high-level and low-level shall be activated simultaneously for about ten (10) seconds.