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(57) Abstract:

National security has always been, and continues to be, one of our nation's top priorities. The first step towards this is securing our border. Effective border security will help keep out criminal activity, terrorists, contraband, drugs and other public safety threats. Protecting our borders from the illegal movement of weapons, drugs, contraband, and people, while promoting lawful trade and travel, is essential to homeland security, economic prosperity, and national sovereignty. However there are many incidents of border breaching and trespassing of people, terrorist and other criminal activities from borders of India. Especially along McMohan line (border along the china) we've witnessed PLA troops tried for intrusion many times. All the border related threats are because there are many gaps along border where manual patrolling 24*7 is not possible. Presently this is the main concern regarding the border security. According to research and analysis of the issue, unmanned surveillance along the border between those vulnerable gaps is required. Indo-Tibetan Border Police asks for the requirement of unmanned surveillance systems like hidden cameras. An idea arose as a result of this situation. Concept is to develop a Hexapod robot that can be transformed into an object allowing ITBP or other military and intelligence organizations to conduct undercover monitoring near the border and to gather intelligence in required situations. Hexapod is a robot with six legs that provides it outstanding stability. The product/robot "Hexapod" is named as "Hexspy" and it can be "transformed" into a "pumpkin" according to the situations making it obvious and unsuspecting to be present at enemy's surroundings. This Hexspy is controlled by an Arduino Uno (micro-

controller), which acts as the brain of the robot. It is a camera mounted robot which provides the user with live video streaming of the borders while remaining undercover. Hexspy is equipped with an IoT Node MCU for establishment of remote communication between the user and the robot. All the data/information collected by the robot is sent to the user's servers. Block chain and cyber security are used to protect data. When data is transferred to a server using block chain technology, it is encrypted, making it unusable in the event of a cyber-attack on the server. In order to prevent such server attacks, cyber security is also employed in the concept. Hexspy also has the ability to self-destruct, preventing it from being used to trace the path of communication. All of these security characteristics combine to make Hexspy a very safe and helpful robotic gadget for border surveillance in vulnerable gaps. Hexspy is best suited for rocky terrain as it has the mechanical abilities of a Hexapod. Many other salient features of this robot make it a magical spying robot capable of providing real-time intelligence to the Indo-Tibetan Border Police or other secret services.

FORM 2

THE PATENTS ACT 1970

(39 of 1970)

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The Patent Rules 2003

COMPLETE SPECIFICATION

(See section 10 and rule 13)

TITLE OF THE INVENTION

**“Transformable Hexapod Surveillance Robot with Pumpkin-Shaped
Camouflage Shell”**

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The following specification particularly describes the nature of the invention and the manner in which it is performed:

FIELD OF THE INVENTION

[0001] The present invention relates to the field of robotic surveillance systems. More particularly, the present invention relates to a transformable undercover surveillance robot configured as a hexapod walking robot capable of transforming
5 into an inanimate camouflage object. The invention specifically relates to a ground-based surveillance robot having a six-legged locomotion structure, servo-actuated transformation, live video streaming, remote communication, position monitoring, and emergency remote disabling capability.

10 BACKGROUND OF THE INVENTION

[0002] Surveillance in vulnerable border regions, restricted areas, hostile zones, and security-sensitive locations requires continuous monitoring without exposing personnel to danger. In several locations, human patrolling cannot be maintained continuously due to terrain, security risk, manpower limitations, and the need for
15 covert intelligence gathering. Conventional surveillance systems such as fixed cameras, manual patrols, aerial monitoring systems, and visible ground robots may be easily detected or may not provide sufficient undercover presence in close-range environments.

[0003] Ground surveillance robots can move into areas where direct human
20 monitoring is unsafe or impractical. However, many such robots are visually identifiable as machines, which reduces their effectiveness in covert operations. A robot that remains visibly mechanical may attract attention, may be removed or damaged, and may compromise the surveillance mission. Therefore, there exists a need for a surveillance robot that can move by itself, capture live visual data,
25 communicate with a remote user, and then disguise itself as a common inanimate object in the surrounding environment.

[0004] The present invention addresses the above requirement by providing a transformable undercover surveillance robot named “Hexspy: The Undercover Robot.” The robot uses a hexapod locomotion arrangement for multi-directional walking and self-balancing movement. The robot includes an Arduino Uno
5 microcontroller, SG-90 servo motors, two 270-degree cameras, an IoT NodeMCU module, and a PLA-based 3D printed pumpkin-shaped outer shell. The robot can transform into a pumpkin-like inanimate camouflage object manually through remote command or automatically upon detection of motion near the robot.

10 **OBJECTIVES OF THE INVENTION**

[0005] An objective of the present invention is to provide a transformable undercover surveillance robot capable of conducting ground-based surveillance while remaining concealed as an inanimate object.

[0006] Another objective of the present invention is to provide a hexapod
15 surveillance robot having six articulated legs actuated by SG-90 servo motors for multi-directional walking and self-balancing movement.

[0007] Another objective of the present invention is to provide a robot controlled by an Arduino Uno microcontroller for locomotion control, servo actuation, transformation command execution, surveillance operation, and remote
20 communication.

[0008] Another objective of the present invention is to provide a surveillance robot having two 270-degree cameras for capturing visual data and providing live video streaming to a remote user.

[0009] Another objective of the present invention is to provide an IoT NodeMCU-based wireless communication arrangement for signal transmission, command execution, live streaming, and position monitoring.

[0010] Another objective of the present invention is to provide a PLA-based 3D
5 printed pumpkin-shaped transformable outer shell that allows the robot to convert into a pumpkin-like camouflage object.

[0011] Another objective of the present invention is to provide both manual and automatic transformation modes, wherein manual transformation is initiated by a remote command and automatic transformation is initiated based on detected
10 motion near the robot.

[0012] Another objective of the present invention is to provide a remotely actuated self-destruction or disabling mechanism for emergency conditions so that the communication path and surveillance system cannot be traced or misused.

15 **SUMMARY OF THE INVENTION**

[0013] The present invention provides a transformable undercover surveillance robot configured for covert monitoring and intelligence gathering. The robot comprises a hexapod locomotion structure having six articulated legs actuated by SG-90 servo motors. The six-legged structure enables multi-directional walking
20 and self-balancing movement, thereby allowing the robot to move over ground surfaces during surveillance operations.

[0014] The robot includes an Arduino Uno microcontroller configured to control locomotion, servo actuation, transformation command execution, surveillance operation, and remote communication. The Arduino Uno functions as the central

control unit of the robot and coordinates the actuation of the SG-90 servo motors during movement and transformation.

[0015] The robot further includes two 270-degree surveillance cameras configured to capture visual data and provide live video streaming. The cameras enable remote visual monitoring by a user during undercover surveillance operation.

[0016] The robot also includes a wireless communication module comprising an IoT NodeMCU module. The IoT NodeMCU module is configured for signal transmission, command execution, live-streaming, and position monitoring between the remote user and the robot.

[0017] The robot further includes a transformable outer shell formed as a PLA-based 3D printed pumpkin-shaped body. The transformable outer shell is operatively controlled through the Arduino Uno and servo actuation so that the hexapod robot can be converted into a pumpkin-like inanimate camouflage object in a surveillance environment.

[0018] The transformation may be initiated manually by a remote user command through the IoT NodeMCU module. The transformation may also be initiated automatically when embedded motion sensing technology detects motion near the robot. The robot further includes a remotely actuated self-destruction mechanism controlled through the IoT communication module in an emergency condition to destroy or disable the robot so that the communication path and surveillance system cannot be traced and misused.

[0019] In this respect, before explaining at least one object of the invention in detail, it is to be understood that the invention is not limited in its application to the details of set of rules and to the arrangements of the various models set forth in

the following description or illustrated in the drawings. The invention is capable of other objects and of being practiced and carried out in various ways, according to the need of that industry. Also, it is to be understood that the phraseology and terminology employed herein are for the purpose of description and should not be
5 regarded as limiting.

[0020] These together with other objects of the invention, along with the various features of novelty which characterize the invention, are pointed out with particularity in the disclosure. For a better understanding of the invention, its operating advantages and the specific objects attained by its uses, reference should
10 be made to the accompanying drawings and descriptive matter in which there are illustrated preferred embodiments of the invention.

BRIEF DESCRIPTION OF DRAWINGS

[0021] The advantages and features of the present invention will be understood
15 better with reference to the following detailed description and claims taken in conjunction with the accompanying drawings, wherein like elements are identified with like symbols, and in which:

[0022] Figure 1 illustrates an idea flowchart of the Hexspy undercover robot, showing the surveillance solution, transformation concept, remote control,
20 emergency destruction/disabling feature, cloud transmission, and major hardware and software elements.

[0023] Figure 2 illustrates the pumpkin-shaped camouflage design and the opened transformable robot configuration, showing how the robot appears as a pumpkin-like object and how the shell opens to expose the internal robot
25 structure.

[0024] Figure 3 illustrates dimensional details of internal support components and the hexagonal base structure associated with the robot assembly.

[0025] Figure 4 illustrates dimensional details of further mechanical portions, including side support, circular component, linkage-type component, and shell component.

[0026] Figure 5 illustrates dimensional details of the pumpkin-shaped shell portion and associated outer body structure.

Reference Numerals

10 100 – Transformable undercover surveillance robot

102 – Hexapod locomotion structure

104 – Six articulated legs

106 – SG-90 servo motors

108 – Arduino Uno microcontroller

15 110 – 270-degree surveillance cameras

112 – Wireless communication module

114 – IoT NodeMCU module

116 – Transformable outer shell

118 – PLA-based 3D printed pumpkin-shaped body

20 120 – Pumpkin-like inanimate camouflage object

122 – Embedded motion sensing technology

124 – Remote user command

126 – Self-destruction mechanism

128 – IoT communication module

25 130 – Surveillance environment

- 132 – Visual data
- 134 – Live video streaming
- 136 – Position monitoring
- 138 – Emergency condition
- 5 140 – Communication path
- 142 – Surveillance system

DETAILED DESCRIPTION OF THE INVENTION

[0027] An embodiment of this invention, illustrating its features, will now be described in detail. The words "comprising," "having," "containing," and "including," and other forms thereof are intended to be equivalent in meaning and be open-ended in that an item or items following any one of these words is not meant to be an exhaustive listing of such item or items or meant to be limited to only the listed item or items.

15 [0028] The terms "first," "second," and the like, herein do not denote any order, quantity, or importance, but rather are used to distinguish one element from another, and the terms "a" and "an" herein do not denote a limitation of quantity, but rather denote the presence of at least one of the referenced item.

[0029] The present invention provides a transformable undercover surveillance robot. The robot is designed as a hardware-based ground surveillance device capable of moving like a hexapod robot and transforming into a pumpkin-like camouflage object. The robot is particularly suitable for surveillance and intelligence gathering in security-sensitive locations where the robot must remain unnoticed.

[0030] The robot comprises a hexapod locomotion structure. The hexapod locomotion structure includes six articulated legs. Each leg is arranged to assist the robot in walking over ground surfaces. The six-legged structure enables stable movement because the robot can remain balanced on three or more legs while
5 other legs are being repositioned. This arrangement provides flexibility in movement and allows the robot to perform multi-directional walking and self-balancing movement.

[0031] The articulated legs are actuated by SG-90 servo motors. The SG-90 servo motors receive control signals and produce mechanical movement for
10 driving the leg portions of the hexapod structure. The servo motors are coordinated by an Arduino Uno microcontroller so that the robot can perform controlled walking, turning, stopping, and transformation-related movement.

[0032] The Arduino Uno microcontroller functions as the central control unit of the robot. The Arduino Uno is configured to control locomotion, servo actuation,
15 transformation command execution, surveillance operation, and remote communication. During locomotion, the Arduino Uno sends actuation commands to the SG-90 servo motors so that the six articulated legs move in a controlled manner. During transformation, the Arduino Uno coordinates servo actuation to move the transformable outer shell into a closed camouflage state or an opened
20 operational state.

[0033] The robot includes two 270-degree surveillance cameras. The cameras are mounted in the robot to capture visual data from the surrounding environment. The cameras provide live video streaming to a remote user so that surveillance can be conducted without direct physical presence of the user near the monitored

location. The use of two 270-degree cameras enables broader visual coverage during monitoring.

[0034] The robot further includes a wireless communication module comprising an IoT NodeMCU module. The IoT NodeMCU module establishes remote communication between the user and the robot. The NodeMCU module is configured for signal transmission, command execution, live streaming, and position monitoring. Through this module, the remote user can send commands to the robot, receive video data, monitor the position of the robot, and initiate transformation or emergency disabling operations.

[0035] The robot includes a transformable outer shell formed as a PLA-based 3D printed pumpkin-shaped body. The use of PLA-based 3D printing allows the shell to be formed in a desired pumpkin-like configuration. The pumpkin-shaped body enables the robot to appear as a common inanimate object when it is in the camouflage state. When the robot reaches a desired surveillance location or when concealment is required, the shell is actuated to cover the visible robotic portions and convert the robot into a pumpkin-like object.

[0036] The transformation of the robot may occur manually or automatically. In the manual mode, a remote user observes the surveillance environment through the live video stream. If the user detects movement or suspects that the robot may be noticed, the user sends a transformation command through the IoT NodeMCU module. The Arduino Uno receives the command and actuates the SG-90 servo motors to transform the robot into the pumpkin-like camouflage object.

[0037] In the automatic mode, embedded motion sensing technology detects motion near the robot. Upon detection of nearby motion, a transformation instruction is generated for the Arduino Uno. The Arduino Uno then causes servo

actuation to move the outer shell into the camouflage configuration. This allows the robot to automatically conceal itself in response to movement in the surrounding environment.

5 **[0038]** In the operational state, the robot can move using its hexapod locomotion structure and can capture live visual data through the two 270-degree surveillance cameras. In the camouflage state, the robot assumes the form of the pumpkin-shaped inanimate object so that it blends with the surrounding environment and becomes less suspicious during undercover surveillance.

10 **[0039]** The robot is powered by a battery, such as a lithium polymer battery, which supplies electrical energy to the Arduino Uno, servo motors, cameras, and IoT NodeMCU module. The hardware arrangement therefore provides a compact and movable surveillance unit capable of remote operation and transformation.

15 **[0040]** The robot may also transmit surveillance data to a server in encrypted form. Such transmission supports secure storage of visual and surveillance-related data. The communication and storage arrangement helps protect surveillance data from unauthorized access during remote monitoring.

20 **[0041]** The robot further comprises a remotely actuated self-destruction mechanism. The self-destruction mechanism is remotely controlled through the IoT communication module in an emergency condition. The emergency condition may include a situation where the robot is at risk of being captured, traced, or misused. Upon activation, the self-destruction mechanism destroys or disables the robot so that the communication path and surveillance system cannot be traced and misused. The disabling may include rendering the surveillance system or communication system inoperative.

[0042] The invention therefore provides a combined mechanical, electronic, and communication-based surveillance robot. The hexapod locomotion structure provides movement and stability. The Arduino Uno provides central control. The SG-90 servo motors provide leg actuation and transformation movement. The two
5 270-degree cameras provide visual monitoring. The IoT NodeMCU module provides remote command and communication. The PLA-based 3D printed pumpkin-shaped body provides undercover camouflage. The manual and automatic transformation modes provide concealment flexibility. The emergency disabling mechanism provides protection against tracing and misuse.

10 **Working of the Invention**

[0043] In use, the robot is initially placed in an operational mode. The Arduino Uno microcontroller controls the SG-90 servo motors to actuate the six articulated legs of the hexapod locomotion structure. The robot moves in the surveillance environment using multi-directional walking and self-balancing movement.

15 [0044] During movement, the two 270-degree surveillance cameras capture visual data from the surroundings. The captured visual data is transmitted as a live video stream to the remote user through the IoT NodeMCU module. The user can monitor the environment remotely and issue commands to the robot.

[0045] When concealment is required, the robot is transformed into a pumpkin-
20 like inanimate camouflage object. In manual transformation, the user sends a conversion command through the IoT NodeMCU module. The Arduino Uno receives the command and actuates the SG-90 servo motors to convert the robot into the pumpkin-shaped camouflage state.

[0046] In automatic transformation, embedded motion sensing technology
25 detects motion near the robot. The Arduino Uno receives or processes the motion-

based signal and actuates the servo motors to transform the robot into the pumpkin-like camouflage object. The robot then appears as an inanimate pumpkin-shaped object in the surveillance environment.

5 [0047] In an emergency condition, the remote user may activate the self-destruction mechanism through the IoT communication module. The self-destruction mechanism destroys or disables the robot so that the communication path and surveillance system cannot be traced and misused.

[0048] The foregoing descriptions of specific embodiments of the present invention have been presented for purposes of illustration and description. They
10 are not intended to be exhaustive or to limit the present invention to the precise forms disclosed, and obviously many modifications and variations are possible in light of the above teaching. The embodiments were chosen and described to best explain the principles of the present invention, and its practical application to thereby enable others skilled in the art to best utilize the present invention and
15 various embodiments with various modifications as are suited to the particular use contemplated. It is understood that various omission and substitutions of equivalents are contemplated as circumstance may suggest or render expedient, but such are intended to cover the application or implementation without departing from the spirit or scope of the claims of the present invention.

20

We Claim:

1. A transformable undercover surveillance robot (100), comprising:
 - a hexapod locomotion structure (102) having six articulated legs (104) actuated by SG-90 servo motors (106) for multi-directional walking and self-balancing movement;
 - an Arduino Uno microcontroller (108) configured to control locomotion, servo actuation, transformation command execution, surveillance operation and remote communication;
 - two 270-degree surveillance cameras (110) for capturing visual data (132) and providing live video streaming (134);
 - a wireless communication module (112) comprising an IoT NodeMCU module (114) for signal transmission, command execution, live-streaming and position monitoring (136) and
 - a transformable outer shell (116) formed as a PLA-based 3D printed pumpkin-shaped body (118), wherein the transformable outer shell (116) is operatively controlled through the Arduino Uno microcontroller (108) and servo actuation to convert the hexapod robot into a pumpkin-like inanimate camouflage object (120) in a surveillance environment (130).
2. The robot (100) as claimed in claim 1, wherein the transformation into the camouflage object (120) is initiated manually and automatically based on detected motion wherein manual transformation is initiated by a remote user command (124) through the IoT NodeMCU module (114), and automatic

transformation is initiated when embedded motion sensing technology (122) detects motion near the robot (100).

3. The robot (100) as claimed in claim 1, comprising a remotely actuated self-destruction mechanism (126) wherein the self-destruction mechanism (126) is remotely controlled through the IoT communication module (128) in an emergency condition (138) to destroy or disable the robot (100) so that the communication path (140) and surveillance system (142) cannot be traced and misused.

Dated this 23rd Day of June 2026

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ABSTRACT

“Transformable Hexapod Surveillance Robot with Pumpkin-Shaped Camouflage Shell”

5

The present invention relates to a transformable undercover surveillance robot (100) configured for covert ground-based monitoring. The robot (100) comprises a hexapod locomotion structure (102) having six articulated legs (104) actuated by SG-90 servo motors (106) for multi-directional walking and self-balancing
10 movement. An Arduino Uno microcontroller (108) controls locomotion, servo actuation, transformation command execution, surveillance operation, and remote communication. The robot (100) includes two 270-degree surveillance cameras (110) for capturing visual data (132) and providing live video streaming (134) to a remote user. An IoT NodeMCU module (114) provides wireless signal
15 transmission, command execution, live streaming, and position monitoring (136). A PLA-based 3D printed pumpkin-shaped body (118) forming a transformable outer shell (116) is operatively controlled through the Arduino Uno microcontroller (108) and servo actuation to convert the robot (100) into a pumpkin-like inanimate camouflage object (120).

20 **(Accompanied Figure No. 1-5)**

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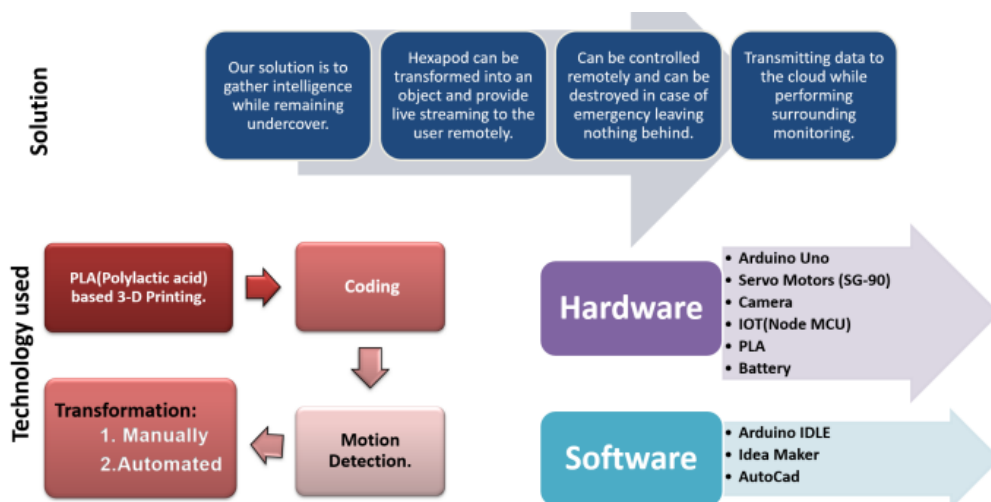


FIG. 1

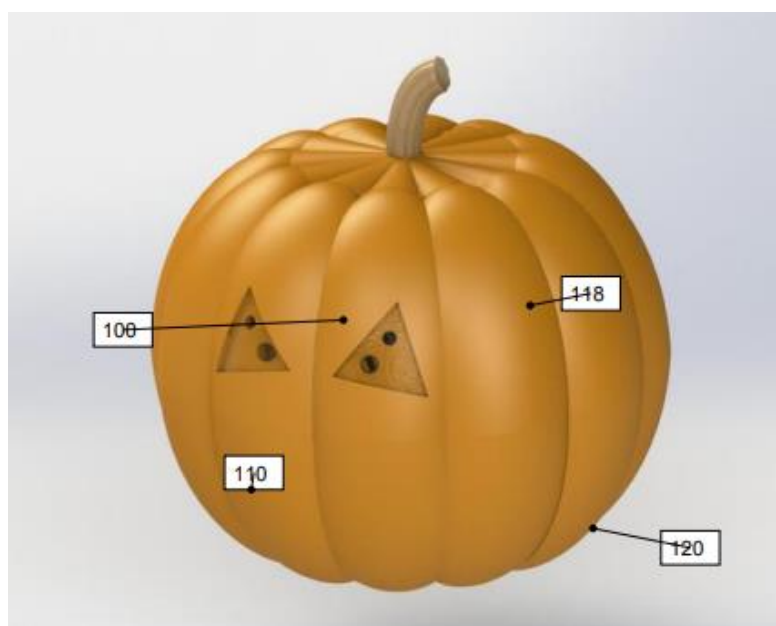


FIG. 2

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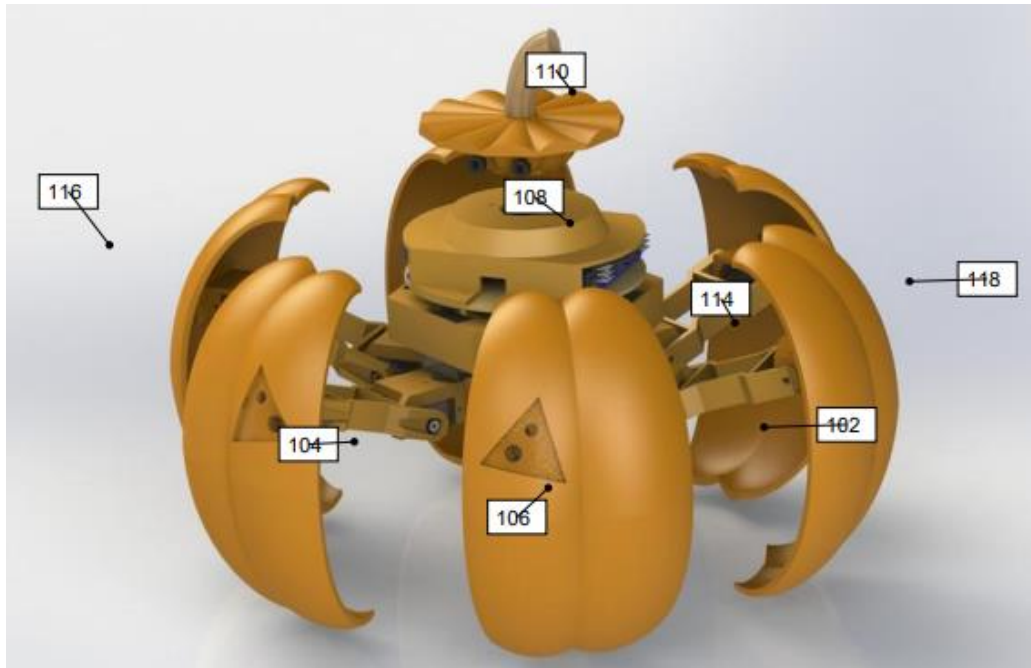


FIG. 3

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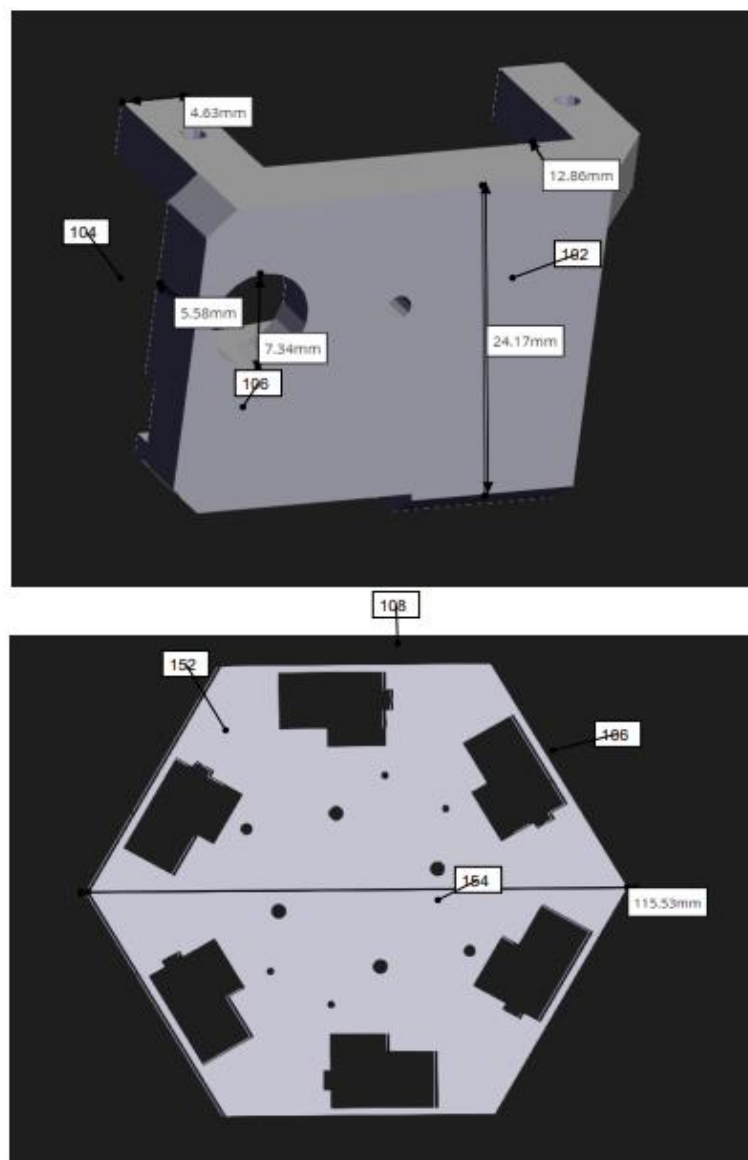


FIG. 4a

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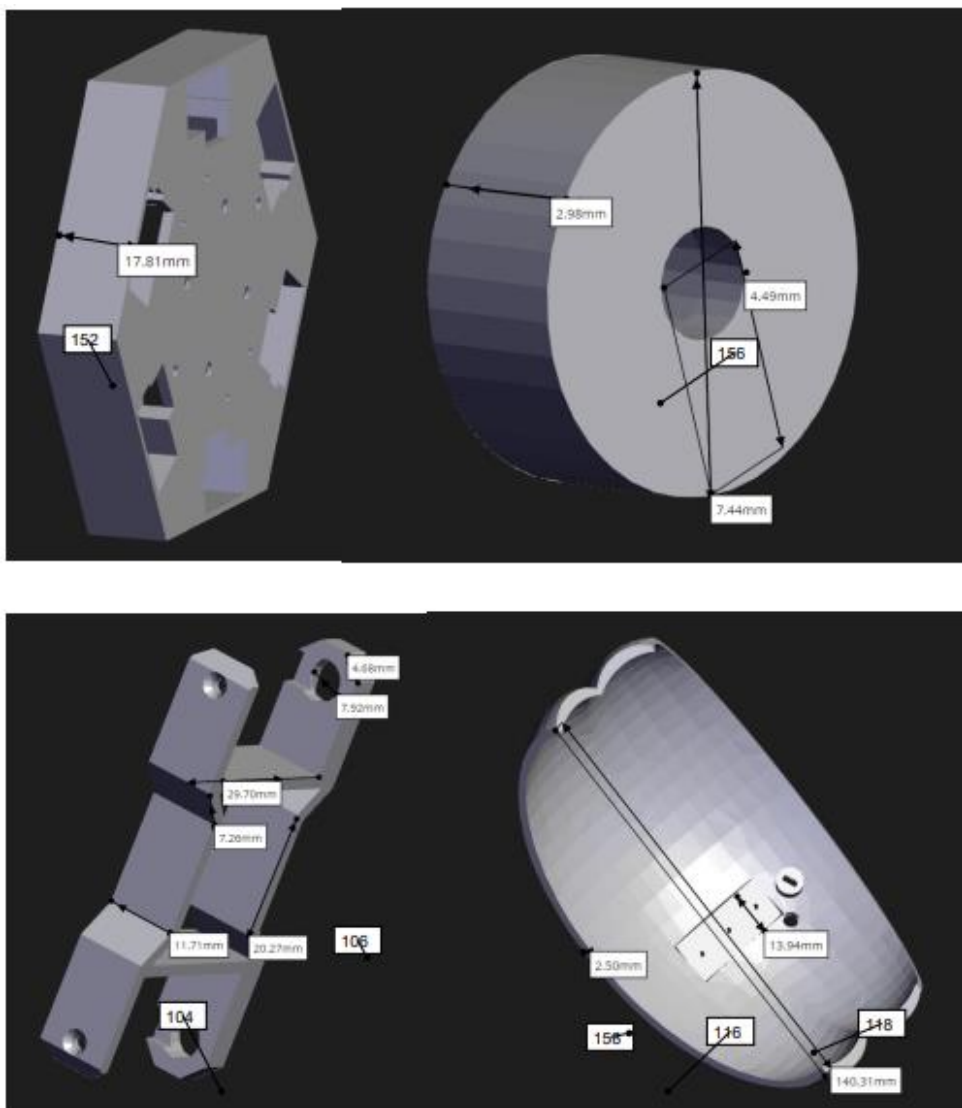


FIG. 4b

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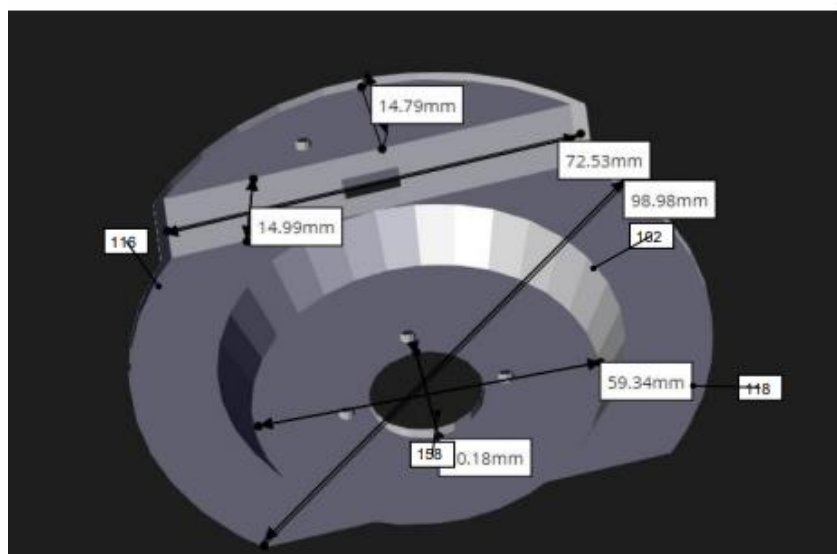
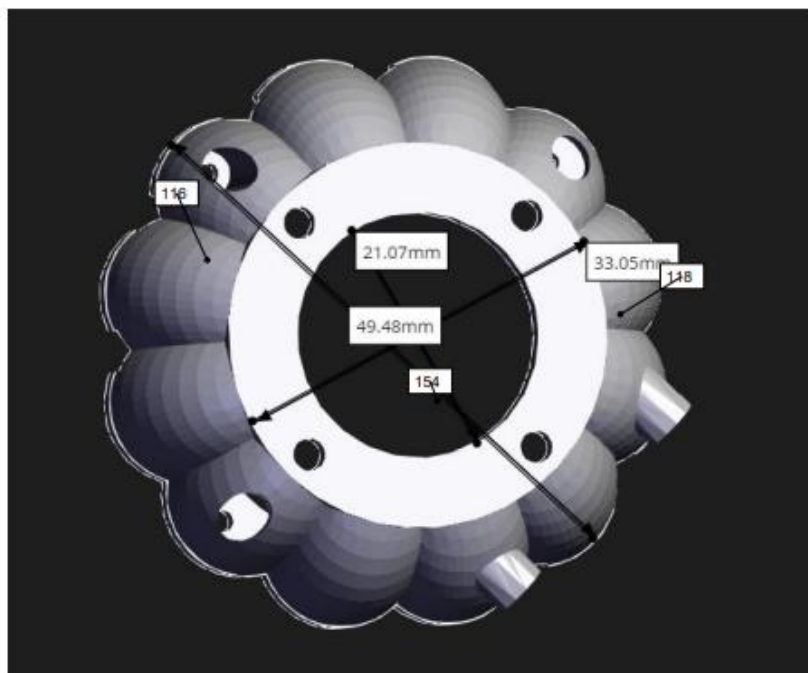


FIG. 5

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