CLAIMS

1. A vehicle traffic control system, comprising:

an emitter configured to emit electromagnetic radiation into a detection area;

a detector configured to detect retro-reflected electromagnetic radiation resulting from retro-reflection of the emitted electromagnetic radiation from retro-reflective ~~elements~~ markers within the detection area, wherein the detector comprises one or more optical filters configured to filter wavelengths of electromagnetic radiation that do not correspond to the electromagnetic radiation emitted by the emitter such that optical detection features of the detector receive substantially only those wavelengths of electromagnetic radiation that include the electromagnetic radiation emitted and retro-reflected to the detector;

control circuitry communicatively coupled to the emitter and the detector, wherein the control circuitry is configured to monitor the retro-reflected electromagnetic radiation detected by the detector and evaluate information relating to one or more vehicles within a detection area based on the monitored retro-reflected electromagnetic radiation; [[and]]

an automated device communicatively coupled to the control circuitry and configured to provide a user-perceivable indication relating to the one or more vehicles in the detection area, wherein the control circuitry is configured to cause the automated device to provide specific user-perceivable indications based on the evaluated information relating to the one or more vehicles;

a parking structure having a parking space, wherein the parking space comprises the retro-reflective markers positioned within an area corresponding to an expected location of a vehicle when the vehicle is parked within the parking space; and

wherein the parking space corresponds to at least a portion of the detection area, and the control circuitry is configured to determine whether the parking space is occupied by the vehicle based on retro-reflection by the retro-reflective markers.

2. – 7. (canceled)

~~8~~ 2. The system of claim 1, ~~comprising:~~

~~a parking structure having a parking space, wherein the parking space comprises retro-reflective markers positioned within an area corresponding to an expected location of a vehicle when the vehicle is parked within the parking space;~~

~~wherein the parking space corresponds to at least a portion of the detection area, and the control circuitry is configured to determine whether the parking space is occupied by the vehicle based on retro-reflection by the retro-reflective markers; and~~

wherein the automated device comprises a light, a communication device, a sign, or any combination thereof, associated with the parking space, wherein the control circuitry is configured to trigger the light, the communication device, the sign, or the combination thereof, based on the occupancy of the parking space.

~~9~~ 3. (currently amended) The system of claim ~~[[8]]~~ 2, wherein the control circuitry is configured to:

correlate the retro-reflected electromagnetic radiation to the retro-reflective markers positioned within the area corresponding to the expected location;

monitor the retro-reflected electromagnetic radiation for changes in retro-reflection by the retro-reflective markers within the area corresponding to the expected location; and

associate changes in retro-reflection by the retro-reflective markers with a coverage of the markers by a vehicle parked within the parking space to determine whether the parking space is occupied.

10. – 14. (canceled)

~~15~~ 4. (currently amended) A method of tracking and controlling the movement of vehicles, comprising:

flooding a detection area with electromagnetic radiation using an emitter, wherein the detection area corresponds to a portion of a parking structure ~~or a vehicle path~~;

detecting electromagnetic radiation that is retro-reflected from retro-reflective markers within the detection area using a detector, wherein a parking space of the parking structure comprises the retro-reflective markers positioned within an area corresponding to an expected location of a vehicle when the vehicle is parked within the parking space, wherein one or more optical filters filter wavelengths of electromagnetic radiation that do not correspond to the electromagnetic radiation emitted by the emitter such that optical detection features of the detector receive substantially only those wavelengths of electromagnetic radiation that include the electromagnetic radiation emitted and retro-reflected to the detector;

monitoring the retro-reflected electromagnetic radiation to evaluate ~~information relating to one or more vehicles within the detection area~~ whether the parking space is occupied by the vehicle using control circuitry communicatively coupled to at least the detector; and

controlling an automated device based, at least in part, on the ~~evaluated vehicle information~~ occupancy of the parking space using the control circuitry to affect movement of the vehicle within the detection area.

16. (canceled)

~~17~~ 5. (currently amended) The method of claim ~~[[16]]~~ 4, wherein monitoring the retro-reflected electromagnetic radiation to evaluate information relating to one or more vehicles within the detection area comprises:

monitoring the retro-reflected electromagnetic radiation for changes indicative of retro-reflective markers no longer retro-reflecting the emitted electromagnetic radiation;

correlating the markers no longer retro-reflecting the emitted electromagnetic radiation to specific parking spaces within the parking structure to determine parking space occupation data; and

wherein controlling the automated device based, at least in part, on the ~~evaluated vehicle information~~ occupancy of the parking space using the control circuitry to affect movement of the vehicle within the detection area comprises providing a user-perceivable parking space recommendation within the parking structure, or outside of the parking structure and along a pathway leading to the parking structure, using a display communicatively coupled to the control circuitry.

18. – 20. (canceled)

CLAIMS

1. A vehicle traffic control system, comprising:

an emitter configured to emit electromagnetic radiation into a detection area;

a detector configured to detect retro-reflected electromagnetic radiation resulting from retro-reflection of the emitted electromagnetic radiation from retro-reflective elements within the detection area;

control circuitry communicatively coupled to the emitter and the detector, wherein the control circuitry is configured to monitor the retro-reflected electromagnetic radiation detected by the detector and evaluate information relating to one or more vehicles within a detection area based on the monitored retro-reflected electromagnetic radiation; and

an automated device communicatively coupled to the control circuitry and configured to provide a user-perceivable indication relating to the one or more vehicles in the detection area, wherein the control circuitry is configured to cause the automated device to provide specific user-perceivable indications based on the evaluated information relating to the one or more vehicles.

2. The system of claim 1, wherein the automated device comprises a traffic light having a first light indicator, a second light indicator, and a third light indicator, and the control circuitry is configured to cause the traffic light to selectively illuminate the first light indicator, the second light indicator, or the third light indicator, based on the evaluated information relating to the one or more vehicles.

3. The system of claim 2, wherein the control circuitry is configured to:

correlate the retro-reflected electromagnetic radiation to retro-reflective markers positioned along two or more roads on opposing ends of an intersection of the two or more roads;

determine whether the detector is not detecting retro-reflected electromagnetic radiation from retro-reflective markers associated with one of the two or more roads;

associate the retro-reflective markers from which retro-reflected electromagnetic radiation is not detected with vehicles positioned over the retro-reflective markers; and

adjust the selective illumination of the first, second, and third light indicators of the traffic light based at least on the association.

4. The system of claim 2, comprising an additional traffic light having a respective first light indicator, a respective second light indicator, and a respective third light indicator, wherein the control circuitry is communicatively coupled to the additional traffic light and is configured to cause the additional traffic light to selectively illuminate the respective first light indicator, the respective second light indicator, or the respective third light indicator, based on the evaluated information relating to the one or more vehicles while also adjusting the selective illumination of the first light indicator, the second light indicator, or the third light indicator of the traffic light.

5. The system of claim 1, wherein the detector comprises one or more optical filters configured to filter wavelengths of electromagnetic radiation that do not correspond to the electromagnetic radiation emitted by the emitter such that optical detection features of the detector receive substantially only those wavelengths of electromagnetic radiation that include the electromagnetic radiation emitted and retro-reflected to the detector.

6. The system of claim 1, comprising:

an entrance path leading to a parking area;

a movable gate disposed along the entrance path, wherein the movable gate is configured to prevent vehicle access to the parking area while the movable gate is in a

closed position and to allow vehicle access to the parking area while the movable gate is in an open position; and

wherein the automated device comprises a gate actuation device coupled to the movable gate and to the control circuitry, wherein the gate actuation device is configured to move the movable gate between the closed and opened position based on control signals from the control circuitry.

7. The system of claim 6, wherein the control circuitry is configured to:

correlate the retro-reflected electromagnetic radiation to a retro-reflective marker associated with a vehicle positioned on the entrance path;

determine whether the detected retro-reflected electromagnetic radiation is associated with an allowed access to the parking area; and

cause the gate actuation device to move the movable gate to the open position if the detected retro-reflected electromagnetic radiation is associated with allowed access to the parking structure.

8. The system of claim 1, comprising:

a parking structure having a parking space, wherein the parking space comprises retro-reflective markers positioned within an area corresponding to an expected location of a vehicle when the vehicle is parked within the parking space;

wherein the parking space corresponds to at least a portion of the detection area, and the control circuitry is configured to determine whether the parking space is occupied by the vehicle based on retro-reflection by the retro-reflective markers; and

wherein the automated device comprises a light, a communication device, a sign, or any combination thereof, associated with the parking space, wherein the control circuitry is configured to trigger the light, the communication device, the sign, or the combination thereof, based on the occupancy of the parking space.

9. The system of claim 8, wherein the control circuitry is configured to:

correlate the retro-reflected electromagnetic radiation to the retro-reflective markers positioned within the area corresponding to the expected location;

monitor the retro-reflected electromagnetic radiation for changes in retro-reflection by the retro-reflective markers within the area corresponding to the expected location; and

associate changes in retro-reflection by the retro-reflective markers with a coverage of the markers by a vehicle parked within the parking space to determine whether the parking space is occupied.

10. The system of claim 1, comprising:

a parking structure having a plurality of parking spaces, wherein each parking space of the plurality of parking spaces comprises retro-reflective markers positioned within an area corresponding to an expected location of a vehicle when the vehicle occupies the parking space;

wherein the control circuitry is configured to determine whether each parking space of the plurality of parking spaces is occupied by a respective vehicle based on retro-reflection by the retro-reflective markers in each parking space;

wherein the automated device comprises a display configured to provide textual or graphical information relating to occupancy of the plurality of parking spaces, wherein the display is positioned outside of the parking structure and along a vehicle path leading to the parking structure, or is a part of a mobile device configured to communicate with the control circuitry; and

wherein the control circuitry is configured to cause the display to update the textual or graphical information based on determined changes in the occupancy associated with the plurality of parking spaces.

11. The system of claim 10, wherein the control circuitry is configured to determine which parking spaces of the plurality of parking spaces are not occupied by a respective vehicle based on substantially unchanged retro-reflection from retro-reflective

markers associated with unoccupied parking spaces, and the control circuitry is configured to cause the display to provide a recommended parking space based at least on the determination of the unoccupied parking spaces.

12. The system of claim 1, comprising:

a parking structure having a parking space corresponding to at least a portion of the detection area;

wherein the automated device comprises a parking attendant notification device, and wherein the control circuitry is configured to:

correlate the retro-reflected electromagnetic radiation to retro-reflective elements positioned on or within a vehicle parked within the parking space;

determine whether the detected retro-reflected electromagnetic radiation is associated with a disabled vehicle; and

if the control circuitry determines that the vehicle is disabled, cause the parking attendant notification device to provide a perceivable indication to a parking attendant that the vehicle in the parking space is disabled.

13. The system of claim 12, wherein the control circuitry is configured to associate the retro-reflected electromagnetic radiation to a retro-reflective marker positioned on a vehicle tag located on or within a vehicle parked within the parking space, and the control circuitry is configured to determine whether the retro-reflective marker is intended to signal that the vehicle is disabled based at least on the retro-reflective marker.

14. The system of claim 1, comprising:

a parking structure having a plurality of parking spaces, the plurality of parking spaces comprising a first set of parking spaces and a second set of parking spaces, wherein the first and second sets of parking spaces are separated from one another by a wall of the parking structure;

wherein the emitter and the detector are positioned on the wall, the detection area comprises a portion of the parking structure proximate an edge of the wall such that the detector has an overhead perspective view of a first expected vehicle path traveling in a first direction around the wall and a second expected vehicle path extending in a second direction around the wall and substantially opposite the first direction, and wherein the first expected vehicle path is associated with a first set of retro-reflective markers and the second expected vehicle path is associated with a second set of retro-reflective markers;

wherein the control circuitry is configured to determine whether a vehicle is traveling along the first expected vehicle path based on monitoring retro-reflection from the first set of retro-reflective markers and the control circuitry is configured to determine whether a vehicle is traveling along the second expected vehicle path based on monitoring retro-reflection from the second set of retro-reflective markers; and

wherein the automated device comprises a first advisory feature communicatively coupled to the control circuitry and configured to provide user-perceivable indications to vehicles traveling along the first expected vehicle path and a second advisory feature communicatively coupled to the control circuitry and configured to provide user-perceivable indications to vehicles traveling along the second expected vehicle path, wherein the control circuitry is configured to adjust the user-perceivable indications provided by the first advisory feature, the second advisory feature, or both, upon determining that a vehicle is present on the first expected vehicle path or the second expected vehicle path.

15. A method of tracking and controlling the movement of vehicles, comprising:

flooding a detection area with electromagnetic radiation using an emitter, wherein the detection area corresponds to a portion of a parking structure or a vehicle path;

detecting electromagnetic radiation that is retro-reflected from within the detection area using a detector;

monitoring the retro-reflected electromagnetic radiation to evaluate information relating to one or more vehicles within the detection area using control circuitry communicatively coupled to at least the detector; and

controlling an automated device based, at least in part, on the evaluated vehicle information using the control circuitry to affect movement of the vehicle within the detection area.

16. The method of claim 15, wherein the detection area is the portion of the parking structure and wherein detecting electromagnetic radiation that is retro-reflected from within the detection area comprises detecting retro-reflected electromagnetic radiation from retro-reflective markers positioned within parking spaces of the parking structure.

17. The method of claim 16, wherein monitoring the retro-reflected electromagnetic radiation to evaluate information relating to one or more vehicles within the detection area comprises:

monitoring the retro-reflected electromagnetic radiation for changes indicative of retro-reflective markers no longer retro-reflecting the emitted electromagnetic radiation;

correlating the markers no longer retro-reflecting the emitted electromagnetic radiation to specific parking spaces within the parking structure to determine parking space occupation data; and

wherein controlling the automated device based, at least in part, on the evaluated vehicle information using the control circuitry to affect movement of the vehicle within the detection area comprises providing a user-perceivable parking space recommendation within the parking structure, or outside of the parking structure and along a pathway leading to the parking structure, using a display communicatively coupled to the control circuitry.

18. The method of claim 15, wherein the detection area comprises two or more intersecting roads and the automated device comprises a traffic light having a plurality of lights, and wherein:

detecting electromagnetic radiation that is retro-reflected from within the detection area comprises detecting retro-reflected electromagnetic radiation from retro-reflective markers positioned along the intersecting roads; and

controlling the automated device based, at least in part, on the evaluated vehicle information using the control circuitry to affect movement of the vehicle within the detection area comprises changing which light of the plurality of lights is illuminated.

19. The method of claim 18, wherein monitoring the retro-reflected electromagnetic radiation to evaluate information relating to one or more vehicles within the detection area comprises:

monitoring retro-reflection associated with retro-reflective markers positioned on different portions of the two or more intersecting roads for changes in retro-reflection by the retro-reflective markers;

associating the changes in retro-reflection by the retro-reflective markers with retro-reflective markers no longer retro-reflecting the emitted electromagnetic radiation, and associating vehicles positioned at a stop over the retro-reflective markers with the retro-reflective markers no longer retro-reflecting the emitted electromagnetic radiation.

20. A vehicle traffic control system comprising control circuitry configured to:

monitor retro-reflected electromagnetic radiation and associate the retro-reflective electromagnetic radiation with retro-reflective elements within a detection area;

identify changes in the retro-reflected electromagnetic radiation and associate the identified changes with vehicle information;

evaluate the vehicle information to determine a movement of the vehicle, a size of the vehicle, a shape of the vehicle, a position of the vehicle, or a combination thereof; and

control an automated device based, at least in part, on the evaluated vehicle information to provide a display or output associated with movement of the vehicle or a position of the vehicle, or both, within the detection area.

CLAIMS

1. A vehicle traffic control system, comprising:

an emitter configured to emit electromagnetic radiation into a detection area;

a detector configured to detect retro-reflected electromagnetic radiation resulting from retro-reflection of the emitted electromagnetic radiation from retro-reflective markers within the detection area, wherein the detector comprises one or more optical filters configured to filter wavelengths of electromagnetic radiation that do not correspond to the electromagnetic radiation emitted by the emitter such that optical detection features of the detector receive substantially only those wavelengths of electromagnetic radiation that include the electromagnetic radiation emitted and retro-reflected to the detector;

control circuitry communicatively coupled to the emitter and the detector, wherein the control circuitry is configured to monitor the retro-reflected electromagnetic radiation detected by the detector and evaluate information relating to one or more vehicles within a detection area based on the monitored retro-reflected electromagnetic radiation;

an automated device communicatively coupled to the control circuitry and configured to provide a user-perceivable indication relating to the one or more vehicles in the detection area, wherein the control circuitry is configured to cause the automated device to provide specific user-perceivable indications based on the evaluated information relating to the one or more vehicles;

a parking structure having a parking space, wherein the parking space comprises the retro-reflective markers positioned within an area corresponding to an expected location of a vehicle when the vehicle is parked within the parking space; and

wherein the parking space corresponds to at least a portion of the detection area, and the control circuitry is configured to determine whether the parking space is occupied by the vehicle based on retro-reflection by the retro-reflective markers.

2. The system of claim 1, wherein the automated device comprises a light, a communication device, a sign, or any combination thereof, associated with the parking space, wherein the control circuitry is configured to trigger the light, the communication device, the sign, or the combination thereof, based on the occupancy of the parking space.

3. The system of claim 2, wherein the control circuitry is configured to:

correlate the retro-reflected electromagnetic radiation to the retro-reflective markers positioned within the area corresponding to the expected location;

monitor the retro-reflected electromagnetic radiation for changes in retro-reflection by the retro-reflective markers within the area corresponding to the expected location; and

associate changes in retro-reflection by the retro-reflective markers with a coverage of the markers by a vehicle parked within the parking space to determine whether the parking space is occupied.

4. A method of tracking and controlling the movement of vehicles, comprising:

flooding a detection area with electromagnetic radiation using an emitter, wherein the detection area corresponds to a portion of a parking structure;

detecting electromagnetic radiation that is retro-reflected from retro-reflective markers within the detection area using a detector, wherein a parking space of the parking structure comprises the retro-reflective markers positioned within an area corresponding to an expected location of a vehicle when the vehicle is parked within the parking space, wherein one or more optical filters filter wavelengths of electromagnetic radiation that do not correspond to the electromagnetic radiation emitted by the emitter such that optical detection features of the detector receive substantially only those wavelengths of electromagnetic radiation that include the electromagnetic radiation emitted and retro-reflected to the detector;

monitoring the retro-reflected electromagnetic radiation to evaluate whether the parking space is occupied by the vehicle using control circuitry communicatively coupled to at least the detector; and

controlling an automated device based, at least in part, on the occupancy of the parking space using the control circuitry to affect movement of the vehicle within the detection area.

5. The method of claim 4, wherein monitoring the retro-reflected electromagnetic radiation to evaluate information relating to one or more vehicles within the detection area comprises:

monitoring the retro-reflected electromagnetic radiation for changes indicative of retro-reflective markers no longer retro-reflecting the emitted electromagnetic radiation;

correlating the markers no longer retro-reflecting the emitted electromagnetic radiation to specific parking spaces within the parking structure to determine parking space occupation data; and

wherein controlling the automated device based, at least in part, on the occupancy of the parking space using the control circuitry to affect movement of the vehicle within the detection area comprises providing a user-perceivable parking space recommendation within the parking structure, or outside of the parking structure and along a pathway leading to the parking structure, using a display communicatively coupled to the control circuitry.