

# SecuriBot

Autonomous Sentinel Robot

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***Abstract-* The SecuriBot is the newest integration to common societal life. As robots get more frequent in society, new inspirations on ways to make tasks easier or more effective arise. A robot focusing on keeping people and their belongings safe creates a new meaning to security system technology carried out within home and industry environments. The SecuriBot is a four-part system with safety and security in mind. Some robotic designs have been created with the intent of creating alternatives to better security systems, however, these designs happen to be quite expensive and lack the security aspects that are incorporated into the SecuriBot's design.**

## I. INTRODUCTION

In all times, people have worked hard to create, shape, and protect their slice of the world. In doing so, methods for protecting these slices have changed throughout time as property, dangers, and technology has changed. Common properties to protect in the current time, are the homes and industrial buildings. Cameras and smoke detectors are some of the technologies used now to ensure these environments are kept safe from the dangers that they protect against.

There are a few issues that modern-day safety and security technology present. One such issue is that the systems tend to be limited in the area that they protect. A basic security camera, for example only has a limited point of view. Cameras with the ability to change their point of view can solve this issue but tend to cost more. Another way to resolve the issue is to place more cameras around the environment. Unfortunately, this method also can cost a significant amount.

Current security and safety systems commonly warn people of an issue as its happening. A smoke detector for example, alerts people of a fire when something has already caught on fire. By this time, the home or industry may already be too unsafe for a person to retreat from.

Security robots only recently have been rising in technological advancements. Some of these robots already happen to exist in largely populated environments. They tend to focus heavily on ensuring the security of the people

around them. Unfortunately, these robots are not very common or used in homes or small industries due to their high costs. Finally, the robots focus heavily on keeping people safe in terms of security, but they do not focus on the potential safety concerns different environments may present.

## II. MATERIALS AND METHODS

The development of the SecuriBot was started in order to provide home and industry owners with a low-cost autonomous sentinel robot. The main difference between the SecuriBot and current security robots is that the SecuriBot also provides safety to people within environments. Being equipped with cameras and sensors, the robot can scan its environment using sight, sound, and temperature detection.

Equipping these sensors and cameras on an autonomous moving platform allows the robot to be a suitable replacement to current safety and security technologies. Using the abilities of sight, sound, and temperature detection, the robot has the potential to find and warn people of dangers before they happen. For example, if an electronic device was starting to heat up, the robot would detect the temperature of the device was rising to dangerous levels and may soon cause a fire. When constructed, the robot is comprised of a sensor, mobility, structure, and power system.

### A. Sensor

Currently, the SecuriBot is equipped with two cameras. The D435 Intel Real Sense Camera provides the robot with the ability to have a sense of depth. With depth recognition, the robot can learn about its environment to be able to do something as simple as object avoidance or something as complicated as object recognition. An Adafruit AMG8833 IR Thermal Camera is equipped on to the robot to provide the robot with the ability to detect thermal-based environmental changes.

The SecuriBot also contains two sensors. To provide the robot with environmental temperature detection, the DHT22 (AM2303) temperature and humidity sensor have been placed on the robot. The SecuriBot equipped with this sensor

allows it to inform a person of the temperature and humidity in the environment and warn them of potential temperature related dangers. Finally, a SparkFun SEN-12642 ROHS Sound Detector has been equipped onto the robot to give it the ability to hear. This gives the robot with the potential to recognize sounds that may cause danger to the environment or the people within it. Each of the sensors and the thermal camera is controlled using an Arduino UNO Board.

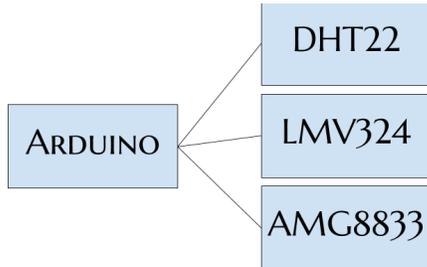


Figure [1]: Sensor and Camera Diagram

### B. Mobility

The mobility system is constructed of four Phidgets DCM4003\_0 high-torque motors incorporating four Nexus robot 14094 100mm Mecanum wheels selected for optimal structural mobility. Two Cytron MDD10A dual-motor drivers are used with an Arduino UNO and a Sparkfun DEV-09947 USB Host Shield for wireless remote control of the SecuriBot.

### C. Structure

The SecuriBot's structure is composed of 80/20 parts 25\_5050 (center column), 1012\_S T-bar structural supports separating two 80/20 2664 HDPE (high-density polyethylene plastic) pegboard platforms all resting on the 0.9m square plywood actuation base.

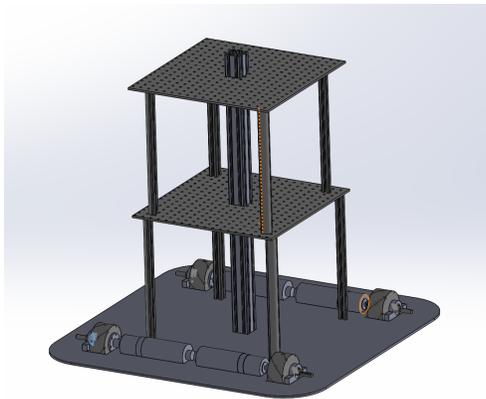


Figure [2]: SecuriBot completed structure

### D. Power

SecuriBot receives power from a 24V battery. The motor controllers are connected directly to the battery whereas the LattePanda is connected to the battery using a step-down

transformer. The sensors then individually receive power from the LattePanda. Since the LattePanda could supply up to 5V and 2A, yielding 10W, the step-down transformer maintains the same power by reducing the voltage from 24V down to 5V while increasing the current from 416mA to 2A. The LattePanda is a computer, and it connects to two Arduino UNOs and a D435 Intel RealSense Depth Camera. Both Arduinos are basically a piece of memory. One Arduino UNO connects to a DHT22 Temp/Humidity, a LMV324 Sounds Sensor, and a AMG8833 Thermal Camera. The other Arduino UNO connects to the two motor controllers where the battery connects to, and each motor controller connects to two motors for a total of four motors. The four motors supply a total of 3A and 24V, and thus each motor supply 750mA.

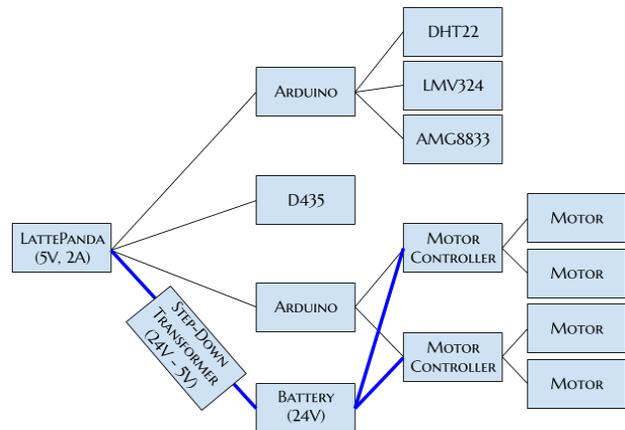


Figure [3]: Power Diagram

## III. DISCUSSION

Currently, the SecuriBot is separated individually into its four main systems, as previously described. In the future the design should be assembled using the structure designed for the SecuriBot. The sensors, D435 Camera, and Mobility system should also be combined using the LattePanda. Acting as the central microcontroller, the LattePanda will have all the programming necessary to make the systems previously described work in unison. In this design, the LattePanda acts as an A.I or the brain of the robot, having the programming necessary to help the robot make decisions based on the information it gathers. As for additional sensors, the SecuriBot's large structure allows room for many sensors to be added onto the robot in the future. The design of the SecuriBot was carefully thought out to be a platform for future development.

## ACKNOWLEDGMENTS

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