Sound and Infrared Motion Activated Pitch and Yaw Aiming System*

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We construct a system that locates a target through sound sensors, and then uses an infrared motion detector to precisely aim on said target. This device is able to determine the optimal angle to fire a projectile. This project has the potential for several applications, such as military training and defense, products relating to recreational entertainment (Nerf, Airsoft, paintball, etc.), and many other fields.

I. INTRODUCTION

The importance of automation within the modern world cannot be understated, a reality furthered by military demands, increasing dependence on robotics, a growing recreational entertainment sector, and by many more aspects of national, as well as international, markets. Due to this, we show in this paper that it is possible to create an inexpensive, simple, and automated aiming system that can be used in virtually any financial sector or military endeavor.

Our aiming system will be dependent on sound and infrared motion, ultimately advancing these features through its pitch and yaw adjustment capabilities. With these components, our device will be able to accurately pinpoint a target and complete a complicated task, highlighting the ability to cost-effectively mass produce similar products.

The overall process of the aiming system will be comprised of three major components: the sound system, the infrared motion sensor, and pitch and yaw aiming.

To begin, the sound system is composed of a stepper motor, two sound sensors, and an Arduino Mega 2560. It is important to note that the Arduino 2560 is not solely present in this component of the device, but is rather the core of the entire project. With that said, if a sound sensor is activated, the base stepper motor will rotate 45 degrees in the direction of whichever sound sensor was triggered. This system will allow the aiming system to hone in on a target based solely off of sound. From this point, the infrared motion sensor component of this device begins.

Once the infrared motion sensor is activated by a signal, the base stepper motor will stop, the red LED will be turned off, and the green LED will be turned on. From here, the detector will inform the aiming system to begin determining the proper angle to fire.

The pitch and yaw aiming system will capitalize off of a distance sensor as this device will facilitate the calculation of the optimal angle to fire in order to hit the target. Once this angle has been determined, a second stepper motor will rotate the "pointing" component attached to the stepper motor until the desired angle is achieved. Once this has happened, the stepper motor will stop rotating, indicating that the device has found its target. Upon completion, the device will ultimately reset itself into the original sound system state.

A. Materials

We will use two rotary actuators in this project, these being the 42BYGHM809 Bi-Polar Stepper Motor. In conjunction with these, two A4988 Stepper Motor Driver boards, two KY-038 big sound sensors, an HC-SR04 ultrasonic sensor, an HC-SR501 PIR infrared motion sensor, an Arduino Mega 2560, two 9 volt batteries, a red LED, and a green LED will be used.

II. SCHEMATICS

The electronics schematic can be readily found in Fig. 1 of this paper. Multicolored wires have been used to increase readability.

The software flow chart of this project can be seen in Fig. 2 below.

The block chart of this project is seen in Fig. 3.

III. PLAN OF IMPLEMENTATION

Week 1: Acquire the proper components and begin design phase.

Week 2: Determine the proper way to use all of the acquired devices, sensors, actuators, etc.

Week 3: Begin and finish building the sound sensor system, as well as begin writing its code.

Week 4: Finish the code for the sound sensor system, begin working on pitch and yaw aiming.

Week 5: Finalize design and code of device, rigorously test in order to find any issues that may arise.

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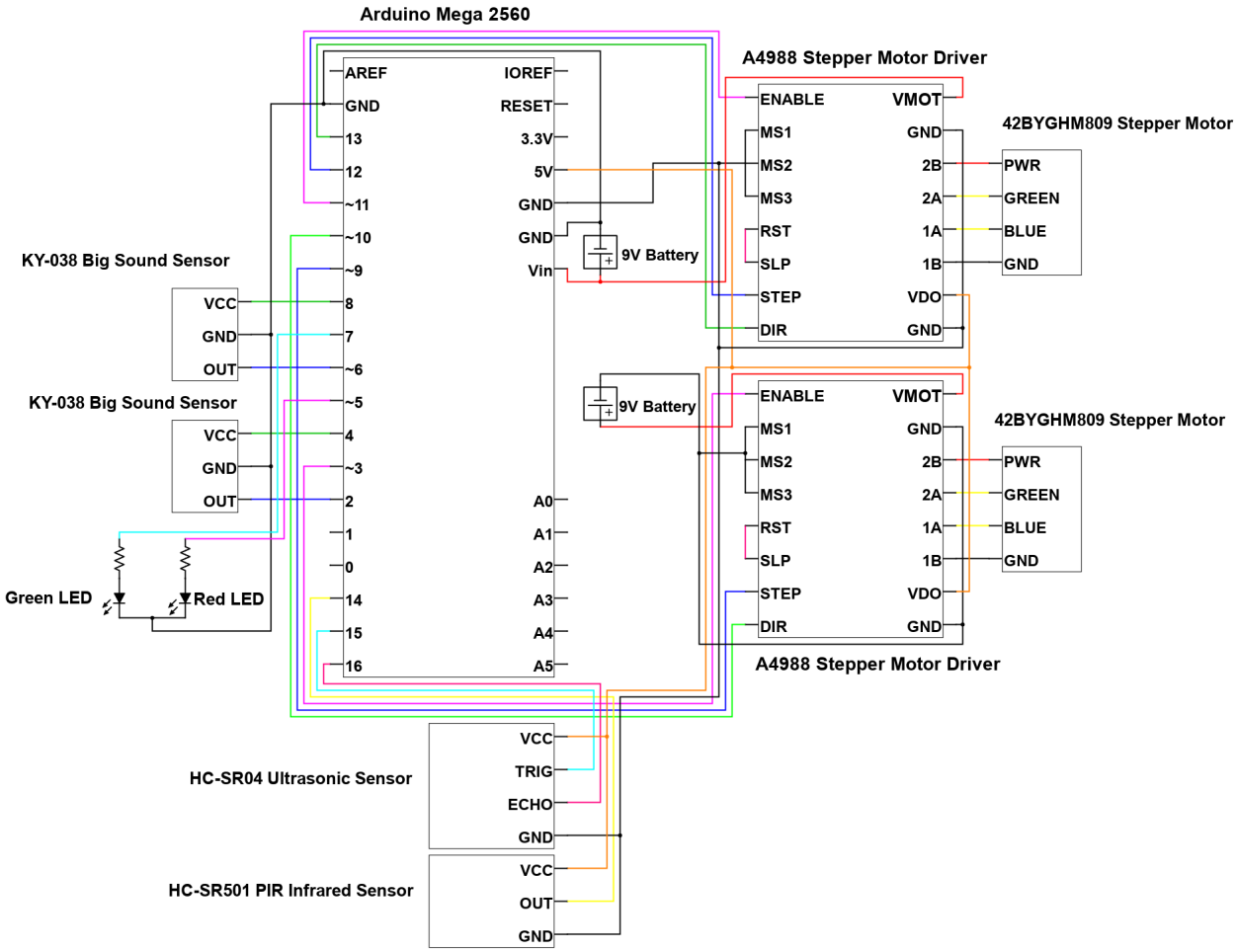

FIG. 1. Electronics Schematic

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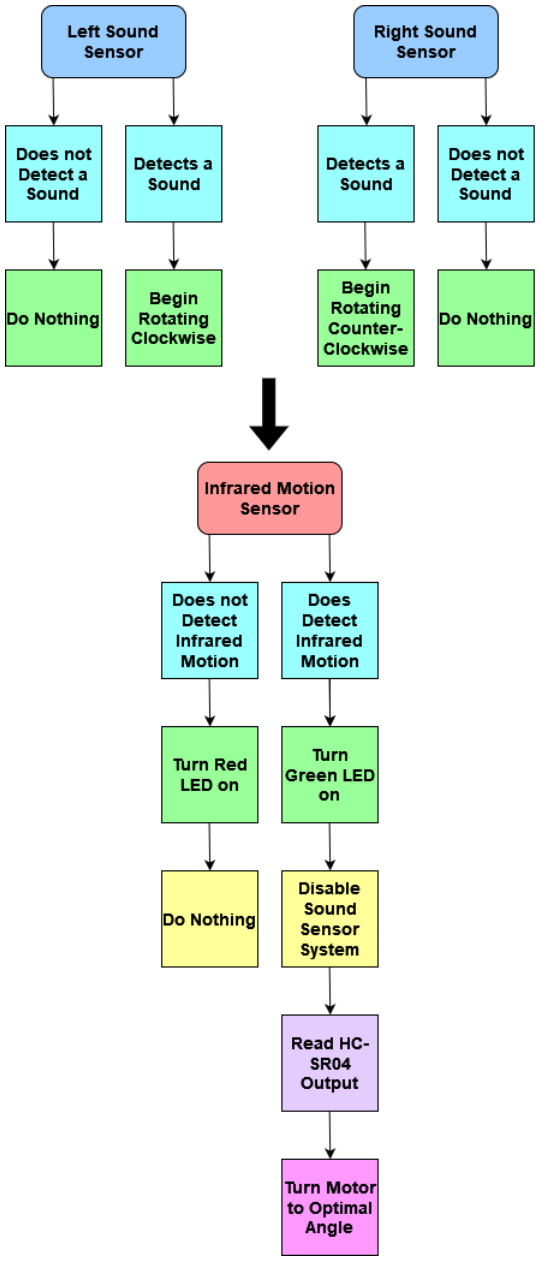

FIG. 2. Software Flow Chart

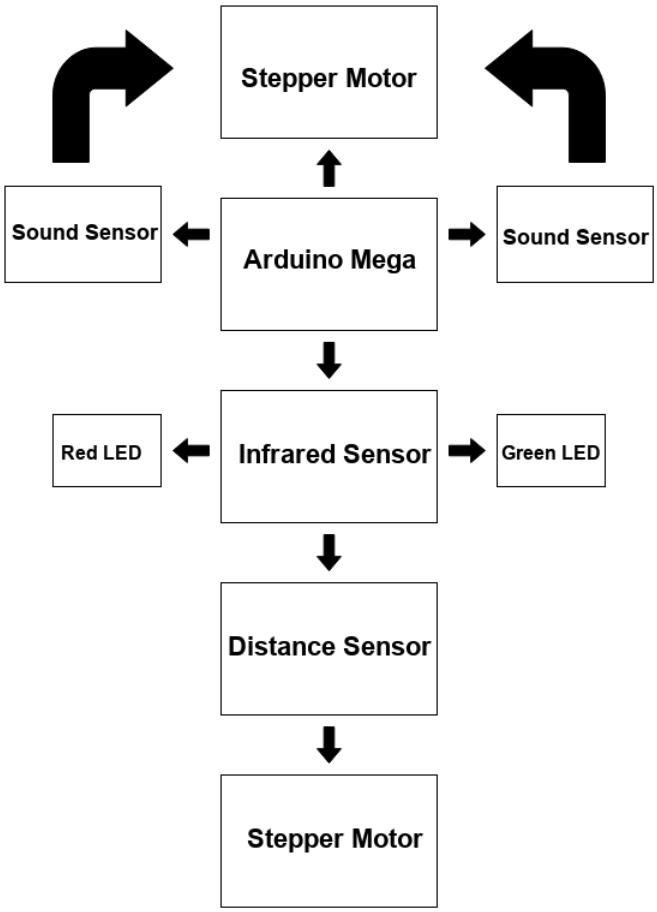

FIG. 3. Block Chart