Department of Computer Science and Engineering  
The University of Texas at Arlington

Team Sketchers

Sidewalk Sketcher

Team Members:   
*Jesus Parra  
Pranil Maharjan  
Sabin Bajracharya*

*Nischal Pandey  
Lam Pham*

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# Introduction

This document provides a detail design specification of the robot Sidewalk Sketcher. It will explain the project over view as well as elaborate the hardware and software components used in the robot. This document will describe the architecture over view of the robot and give an insight description of layers used. In addition it will provide knowledge about Sidewalk Sketchers’ subsystems and their modules. Next the document will provide an explanation of how each layer, subsystem and modules communicate through dataflow diagram. A table of requirement mapping is provided to show how the requirements are accomplished by the robot and finally, an over view of acceptance criteria is provided for the quality assurance.

# Architecture Overview

# System Hardware Description

# Software Input Layer

The purpose of the Software Input Layer is to accept input from the User Interface and output the image in way the system can manipulate. This layer is responsible for reading the image file, converting the image to an appropriate data file, and outputting the data to the Software Processing Layer for final processing.

## Image Reader

## Converter System

## Transfer Data

# Software Output Layer

The purpose of the Software Output Layer is to provide processed information or requested data to the hardware component in a format that it will be able to process. The output of the software component for the Sidewalk Sketcher will be handled in this layer and this will ultimately serve as the input for the hardware component.

## Data Packager

## File Generator

## File transfer

# Software Processing Layer

The purpose of the Software Processing Layer is to handle all the software input data, process that data and then send it to the output layer. Also, the processing layer should retrieve and save files in the data storage layer. This layer will handle all of the processing involved in the back end logic that the user will request through the User Interface Layer.

## Image Processing

## Information Processing

# User Interface Layer

The User Interface Layer allows the user to select an image that will be used by Sidewalk Sketcher to draw an image. It will also allow user to crop and resize an image to provide flexibility to users to sketch desired size and portion of selected image. The interface will provide an option to view the chalk color that will be used when the image is actually being sketched. This layer however, will not insure that the image looks in real life like it will look in the user interface because the actual color will depend on what colors are actually loaded into the Sidewalk Sketcher.

## File Browser Subsystem

## Cropping Subsystem

## Resize Subsystem

## Color Selector Subsystem

# Data Storage Layer

The Data Storage Layer contains all the subsystems that manages and holds a repository of all the image and data files saved by or accessed by the application. These images and data files may be requested from the Database Manager Subsystem for Image Processing in the Software Processing Layer.

## Image Repository

## File Repository

## Database Management

# Hardware Input Layer

This layer is responsible for reading input from Software Output Layer, Sketch layer and Motion layer, packaging all these inputs and sending it to the hardware processing layer. This layer includes the File reader subsystem, Sensor Reader subcomponent, Transfer Data, Camera Processing and Synchronization Input Subsystem. Input from Power Button and Start Button is also read in this layer.

## File Reader Subsystem

## Synchronization Input Subsystem

## Camera Processing

# Hardware Output Layer

All the hardware outputs in the form of light and sound are taken care of in this layer. It includes alarm subsystem, output De-multiplexer and Light subsystem. This layer depends on the output from hardware output driver subsystem of Hardware processing layer.

## Alarm Subsystem

## Output De-multiplexer

# Hardware Processing Layer

The purpose of the Hardware Processing Layer is to analyze and process data as well communicate with the remainder of the hardware layers: Hardware Input Layer, Hardware Output Layer, Sketch layer and the Motion Layer. This layer is the central processing unit of the hardware. Essentially this is the microcontroller in the hardware that controls all of the motions including the Hardware Input Layer, the Hardware Output Layer, the Sketching Layer and the Motion Layer. The sections below provide a detailed description of this layer and its subcomponents – Hardware Input Driver Subsystem, Hardware Output Driver Subsystem, Synchronization Subsystem, Position Processing Subsystem, and the Motion Subsystem.

## Hardware Input Driver Subsystem

## Hardware Output Driver Subsystem

## Synchronization Subsystem

## Sketcher Processing Subsystem

## Position Processing Subsystem

# Sketch Layer

The purpose of the Sketch Layer is to analyze all of the actions that will be performed by the sketching device that will drag the chalk, pick up the chalk when it’s not drawing, and send the update to the Hardware Processing Layer when the chalk nears depletion This layer will communicate directly to the Hardware Processing Layer and the Hardware Input Layer. With the Hardware Processing Layer, it will commute to let the processor know whether or not the chalk is near depletion along with whether the device should be in its writing state or in its floating state (floating meaning it is picked up because it is passing an area that there is no lines to be drawn) This layer will communicate with the Hardware Input Layer because it will have to send senor information to make sure the chalk is connecting to the ground when it is supposed to be sketching the image.

## Sketcher Synchronization Subsystem

## Depletion Subsystem

# Motion Layer

The purpose of the Motion Layer is to analyze the mechanical motion that will perform from the Sidewalk Sketcher and to ensure that the device is on the correct path. This layer will communicate directly to the Hardware Processing Layer and the Hardware Input Layer. With the Hardware Processing Layer which will commute to let the processor know where in the robot is at any given position so that the processing unit can determine where to go next and let this layer know the updated information. This layer will communicate with the Hardware Input Layer because it will have to send the positioning data collected from the data and sync this input to know its absolute position relative to the marker devices used for positioning.

## Motion Synchronization Subsystem

## Motion-Driver Subsystem

# Quality Assurance

# Requirements Mapping

This section provides an overview of the key system requirements and how each layer provides its functionality to meet the requirement through a table. Note that the layers present in the table are only layers that complete key requirements. Some layers that are required to run the system are not present in this table.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Requirement Number | Requirement Name | Hardware Input Layer | Hardware Output Layer | Sketch Layer | Motion Layer | UI Layer | Hardware Processing Layer |
| 3.1 | Sketch Image |  |  | x |  |  |  |
| 3.2 | Sidewalk Sketcher Multicolor |  |  |  |  | x |  |
| 3.7 | Sketch Dimensions |  |  |  |  | x |  |
| 3.8 | Chalk Switch |  |  |  |  |  | x |
| 8.1 | Image Loading |  |  |  |  |  | x |
| 8.5 | Push Chalk |  |  |  |  |  | x |
| 8.6 | Finished Image |  | x |  |  |  |  |
| 8.7 | Depletion Sensing | x |  |  |  |  |  |
| 8.8 | Chalk Reload |  | x |  |  |  |  |
| 8.9 | Positioning |  |  |  | x |  |  |

# Acceptance Criteria

# Appendix