

## **Integrating Smart Traffic Management and Electric Energy Generation at Intersections**

### **Progress:**

#### Arduino Hardware Familiarization:

We exhaustively investigated the Arduino Uno board, its physical components, and pin layouts to understand its potential and limitations. Moreover, we also studied about how to interface ultrasonic sensor with Arduino Board, explored the method of connecting and powering the sensor.

#### Arduino Programming Familiarization:

We learned the essentials of Arduino programming, including variables, data types, control structures, and functions, using online tutorials and reference materials. We also went through how we program our sensor, write code to initialize, calibrate, and read data from sensors. We devised logic to interpret sensor data and dynamically adjust traffic signal timings based on traffic density.

#### Data Collection Initialization for traffic signal logic:

As in the logic of traffic system, we will set a green light duration of for each car, we should fix a value for this purpose. We will utilize the data set [1] for calculating the time per car crossing and that will be using for finalizing green light timing for each car. Again, in traffic system logic, we will worked out a traffic cycle length with fix duration of red, yellow, green light and pedestrian passing. In addition, a maximum threshold for green light duration will be fixed to give pedestrian priority. For executing all of these logic we will make use of these data of this website[2].

#### Piezoelectric power generation testing:

The transducers for piezoelectric power generation from the weight of vehicles have been procured. Testing of these sensors have been conducted by applying pressure on them manually and lighting LEDs using the voltage generated.

### **Methodology Employed to Achieve Progress:**

#### Division of work and regular meetings:

Work for the entire month of February was planned and targets set for each week. The work was divided among each member and group meetings were conducted twice a week, one in-person and one online, to track progress, discuss and help each other's parts.

#### Seeking Expertise:

The team has seeked expert advice from a graduate researcher in the field of electrical engineering. The guidance and motivation received were invaluable for our progress.

Researching different sources to get data: For collecting the traffic signal data we chose some reference (given in the reference section) that we will use for our traffic light cycle.

#### Researching other projects for knowledge:

The team has done research on already existing projects with similar methodology to gain valuable insights on best practices, potential roadblocks and to understand the practicality of our approach (circuits, connections, programming logic, etc.).

### **Challenges:**

Hardware Component Delays: One of the challenges we encountered while working on our project was the delay in getting all of the required hardware components, which affected the project timeline and required adjustments in our schedule.

Real-time Data Collection: Another challenge was to collect real-time data for traffic light signals. As we are using toy cars to test our sensor we don't have any real-time data, but we need data to calculate the

green light timing. Thus we searched Kaggle, Government of Canada and several website for finding suitable data for our projects.

Hardware Damage During Testing: Additionally, we damaged some of our hardware while testing. This also caused delay in our project. However, it taught us to be more careful and to have backup plan if something goes wrong.

#### Workload Distribution:

	Arduino Hardware Familiarization	Arduino Programming Familiarization	Data Collection and Piezoelectric generation testing
<b>Naveen</b>	Familiarized with Arduino, its ports, and the connections		Testing the working of piezoelectric sensors
<b>Kumkum</b>	Explored how Arduino functions and connections	Acquired knowledge on programming sensor	
<b>Arpita</b>	Familiarized with how Arduino operates	Studied the essentials of Arduino programming	
<b>Reeja</b>	Studied the functionality of Arduino and its ports		Gathered past real-time data and analyzed them

#### List of Planned Work:

	Implementation	Testing	Deliverables
<b>Feb 18-24</b>	-Connecting different hardware components based on a developed circuit design. -Developing code for microcontroller in Arduino IDE platform.	-Testing the proper functioning of all the components and their connections. -Check for compilation and upload errors in Arduino IDE's console	-Initial circuit
<b>Feb 25-Mar 2</b>	-Collecting sensor data for different scenarios. -Rectifying connections and code based on testing outcomes.		-Modified circuit with necessary corrections
<b>Mar 3-9</b>	-Deploying communication protocol between Arduino and local server.	-Testing whether data is visualized as desired on the cloud platform.	
<b>Mar 10-16</b>	-Deploying communication between local and cloud server.	-Final testing	-Final Model

#### Reference:

1. <https://open.canada.ca/data/en/dataset/584de76b-13b9-47ea-af12-0c37b8eb5de5/resource/c439060e-fb68-4771-aa02-7db37ef9b836>
2. <https://nacto.org/publication/urban-street-design-guide/intersection-design-elements/traffic-signals/signal-cycle-lengths/>