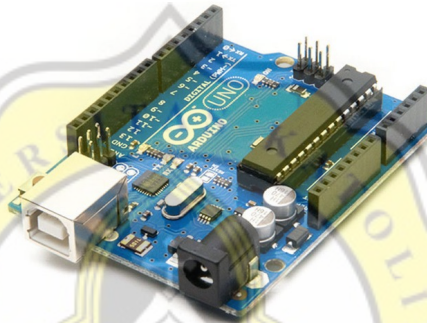# CHAPTER 4

ANALYSIS AND DESIGN

4.1 Analysis

This Project aims to calculate the distance and number of vehicles every second. Required Tools:

1. Arduino UNO

4.1.1 Arduino UNO

2. Ultrasonic Sensor

4.1.2 Ultrasonic Sensor

3. LAN Cable

4.1.3 LAN Cable

4. Jumper Cable

4.1.4 Jumper Cable

Data Collecting

The test is carried out for three days

>. Day 1 Ultrasonic Sensor for car lane

Picture 1: Data for Car Lane Day One

←T→				waktu	tinggi_mobil	diffwaktu
☐	🖉 Ubah	📋 Salin	⊖ Hapus	2020-06-12 08:01:16	135	29
☐	🖉 Ubah	📋 Salin	⊖ Hapus	2020-06-12 08:01:45	180	1
☐	🖉 Ubah	📋 Salin	⊖ Hapus	2020-06-12 08:01:46	181	1
☐	🖉 Ubah	📋 Salin	⊖ Hapus	2020-06-12 08:01:47	180	2
☐	🖉 Ubah	📋 Salin	⊖ Hapus	2020-06-12 08:01:49	180	1
☐	🖉 Ubah	📋 Salin	⊖ Hapus	2020-06-12 08:01:50	180	1
☐	🖉 Ubah	📋 Salin	⊖ Hapus	2020-06-12 08:01:51	180	22
☐	🖉 Ubah	📋 Salin	⊖ Hapus	2020-06-12 08:02:13	149	1
☐	🖉 Ubah	📋 Salin	⊖ Hapus	2020-06-12 08:02:14	149	3
☐	🖉 Ubah	📋 Salin	⊖ Hapus	2020-06-12 08:02:17	140	105
☐	🖉 Ubah	📋 Salin	⊖ Hapus	2020-06-12 08:04:02	177	2
☐	🖉 Ubah	📋 Salin	⊖ Hapus	2020-06-12 08:04:04	177	1
☐	🖉 Ubah	📋 Salin	⊖ Hapus	2020-06-12 08:04:05	177	1
☐	🖉 Ubah	📋 Salin	⊖ Hapus	2020-06-12 08:04:06	177	56

>. Day 1 Ultrasonic Sensors for first path of a motorcycle

Picture 2: Data for First Path of a Motorbike Day One

				waktu	tinggi_motor1	diffwaktu
☐	Ubah	Salin	Hapus	2020-06-12 08:02:15	151	3
☐	Ubah	Salin	Hapus	2020-06-12 08:02:18	146	1
☐	Ubah	Salin	Hapus	2020-06-12 08:02:19	151	2
☐	Ubah	Salin	Hapus	2020-06-12 08:02:21	149	1
☐	Ubah	Salin	Hapus	2020-06-12 08:02:22	149	1
☐	Ubah	Salin	Hapus	2020-06-12 08:02:23	148	2
☐	Ubah	Salin	Hapus	2020-06-12 08:02:25	146	1
☐	Ubah	Salin	Hapus	2020-06-12 08:02:26	140	1
☐	Ubah	Salin	Hapus	2020-06-12 08:02:27	138	2
☐	Ubah	Salin	Hapus	2020-06-12 08:02:29	135	1
☐	Ubah	Salin	Hapus	2020-06-12 08:02:30	141	3
☐	Ubah	Salin	Hapus	2020-06-12 08:02:33	151	1
☐	Ubah	Salin	Hapus	2020-06-12 08:02:34	154	2
☐	Ubah	Salin	Hapus	2020-06-12 08:02:36	155	1
☐	Ubah	Salin	Hapus	2020-06-12 08:02:37	156	1
☐	Ubah	Salin	Hapus	2020-06-12 08:02:38	154	104

>. Day 1 Ultrasonic Sensors for the second motorbike lanes

Picture 3: Data for Second Motorbike Lanes Day One

				waktu	tinggi_motor2	diffwaktu
☐	Ubah	Salin	Hapus	2020-06-12 08:02:00	159	1
☐	Ubah	Salin	Hapus	2020-06-12 08:02:01	165	2
☐	Ubah	Salin	Hapus	2020-06-12 08:02:03	166	1
☐	Ubah	Salin	Hapus	2020-06-12 08:02:04	160	1
☐	Ubah	Salin	Hapus	2020-06-12 08:02:05	161	1
☐	Ubah	Salin	Hapus	2020-06-12 08:02:06	161	197
☐	Ubah	Salin	Hapus	2020-06-12 08:05:23	157	3
☐	Ubah	Salin	Hapus	2020-06-12 08:05:26	159	1
☐	Ubah	Salin	Hapus	2020-06-12 08:05:27	51	3
☐	Ubah	Salin	Hapus	2020-06-12 08:05:30	35	3
☐	Ubah	Salin	Hapus	2020-06-12 08:05:33	59	1
☐	Ubah	Salin	Hapus	2020-06-12 08:05:34	173	2
☐	Ubah	Salin	Hapus	2020-06-12 08:05:36	173	1
☐	Ubah	Salin	Hapus	2020-06-12 08:05:37	172	1
☐	Ubah	Salin	Hapus	2020-06-12 08:05:38	170	1

>. Day 2 Ultrasonic Sensor for car lane

Picture 4: Data for Car Lane Day Two

			waktu	tinggi_mobil	diffwaktu
☐	Ubah ⌖ Salin	⊖ Hapus	2020-06-17 07:29:02	180	1
☐	Ubah ⌖ Salin	⊖ Hapus	2020-06-17 07:29:03	180	1
☐	Ubah ⌖ Salin	⊖ Hapus	2020-06-17 07:29:04	181	2
☐	Ubah ⌖ Salin	⊖ Hapus	2020-06-17 07:29:06	180	249
☐	Ubah ⌖ Salin	⊖ Hapus	2020-06-17 07:33:15	175	1
☐	Ubah ⌖ Salin	⊖ Hapus	2020-06-17 07:33:16	174	7
☐	Ubah ⌖ Salin	⊖ Hapus	2020-06-17 07:33:23	178	1
☐	Ubah ⌖ Salin	⊖ Hapus	2020-06-17 07:33:24	178	2
☐	Ubah ⌖ Salin	⊖ Hapus	2020-06-17 07:33:26	177	1
☐	Ubah ⌖ Salin	⊖ Hapus	2020-06-17 07:33:27	177	27
☐	Ubah ⌖ Salin	⊖ Hapus	2020-06-17 07:33:54	174	2
☐	Ubah ⌖ Salin	⊖ Hapus	2020-06-17 07:33:56	175	1
☐	Ubah ⌖ Salin	⊖ Hapus	2020-06-17 07:33:57	174	1
☐	Ubah ⌖ Salin	⊖ Hapus	2020-06-17 07:33:58	174	90

>. Day 2 Ultrasonic Sensors for first path of a motorcycle

Picture 5: Data for First Path of a Motorbike Day Two

			waktu	tinggi_motor1	diffwaktu
☐	Ubah ⌖ Salin	⊖ Hapus	2020-06-17 07:05:24	178	1
☐	Ubah ⌖ Salin	⊖ Hapus	2020-06-17 07:05:25	178	1190
☐	Ubah ⌖ Salin	⊖ Hapus	2020-06-17 07:25:15	169	1
☐	Ubah ⌖ Salin	⊖ Hapus	2020-06-17 07:25:16	171	1
☐	Ubah ⌖ Salin	⊖ Hapus	2020-06-17 07:25:17	170	2
☐	Ubah ⌖ Salin	⊖ Hapus	2020-06-17 07:25:19	168	2
☐	Ubah ⌖ Salin	⊖ Hapus	2020-06-17 07:25:21	159	2
☐	Ubah ⌖ Salin	⊖ Hapus	2020-06-17 07:25:23	160	1
☐	Ubah ⌖ Salin	⊖ Hapus	2020-06-17 07:25:24	164	1
☐	Ubah ⌖ Salin	⊖ Hapus	2020-06-17 07:25:25	158	3
☐	Ubah ⌖ Salin	⊖ Hapus	2020-06-17 07:25:28	170	1
☐	Ubah ⌖ Salin	⊖ Hapus	2020-06-17 07:25:29	172	1
☐	Ubah ⌖ Salin	⊖ Hapus	2020-06-17 07:25:30	173	1
☐	Ubah ⌖ Salin	⊖ Hapus	2020-06-17 07:25:31	170	3
☐	Ubah ⌖ Salin	⊖ Hapus	2020-06-17 07:25:34	167	1
☐	Ubah ⌖ Salin	⊖ Hapus	2020-06-17 07:25:35	169	1
☐	Ubah ⌖ Salin	⊖ Hapus	2020-06-17 07:25:36	170	2

>. Day 2 Ultrasonic Sensors for the second motorbike lane

Picture 6: Data for Second Motorbike Lanes Day Two

←T→				waktu	tinggi_motor2	diffwaktu
☐	Ubah	Salin	Hapus	2020-06-17 07:25:15	171	1
☐	Ubah	Salin	Hapus	2020-06-17 07:25:16	173	1
☐	Ubah	Salin	Hapus	2020-06-17 07:25:17	169	2
☐	Ubah	Salin	Hapus	2020-06-17 07:25:19	169	2
☐	Ubah	Salin	Hapus	2020-06-17 07:25:21	162	2
☐	Ubah	Salin	Hapus	2020-06-17 07:25:23	165	1
☐	Ubah	Salin	Hapus	2020-06-17 07:25:24	164	1
☐	Ubah	Salin	Hapus	2020-06-17 07:25:25	164	1
☐	Ubah	Salin	Hapus	2020-06-17 07:25:26	163	2
☐	Ubah	Salin	Hapus	2020-06-17 07:25:28	159	2
☐	Ubah	Salin	Hapus	2020-06-17 07:25:30	168	1
☐	Ubah	Salin	Hapus	2020-06-17 07:25:31	169	1
☐	Ubah	Salin	Hapus	2020-06-17 07:25:32	173	1
☐	Ubah	Salin	Hapus	2020-06-17 07:25:33	170	3
☐	Ubah	Salin	Hapus	2020-06-17 07:25:36	165	1
☐	Ubah	Salin	Hapus	2020-06-17 07:25:37	167	1
☐	Ubah	Salin	Hapus	2020-06-17 07:25:38	171	2

>. Day 3 Ultrasonic Sensor for car lanes

Picture 7: Data for Car Lane Day Three

←T→				waktu	tinggi_mobil	diffwaktu
☐	Ubah	Salin	Hapus	2020-06-26 07:39:40	177	2
☐	Ubah	Salin	Hapus	2020-06-26 07:39:42	174	1
☐	Ubah	Salin	Hapus	2020-06-26 07:39:43	175	1
☐	Ubah	Salin	Hapus	2020-06-26 07:39:44	177	1
☐	Ubah	Salin	Hapus	2020-06-26 07:39:45	175	440
☐	Ubah	Salin	Hapus	2020-06-26 07:47:05	180	1
☐	Ubah	Salin	Hapus	2020-06-26 07:47:06	182	1
☐	Ubah	Salin	Hapus	2020-06-26 07:47:07	183	2
☐	Ubah	Salin	Hapus	2020-06-26 07:47:09	183	3
☐	Ubah	Salin	Hapus	2020-06-26 07:47:12	183	1
☐	Ubah	Salin	Hapus	2020-06-26 07:47:13	182	1
☐	Ubah	Salin	Hapus	2020-06-26 07:47:14	182	4

>. Day 3 Ultrasonic Sensors for first path of a motorcycle

Picture 8: Data for First Path of a Motorbike Day Three

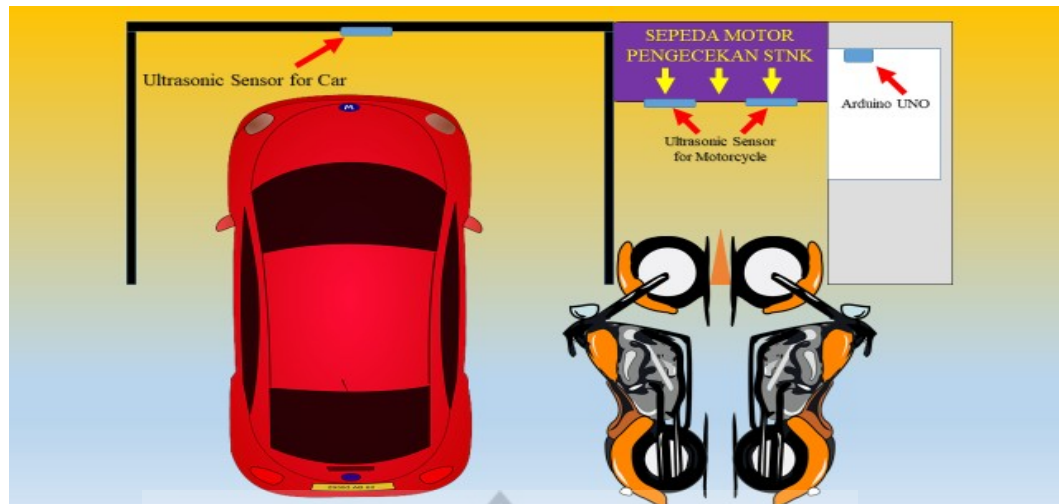|	waktu	tinggi_motor1	diffwaktu
☐ ✎ Ubah ⅔ Salin ⊖ Hapus	2020-06-26 07:34:28	150	2
☐ ✎ Ubah ⅔ Salin ⊖ Hapus	2020-06-26 07:34:30	156	1
☐ ✎ Ubah ⅔ Salin ⊖ Hapus	2020-06-26 07:34:31	155	1
☐ ✎ Ubah ⅔ Salin ⊖ Hapus	2020-06-26 07:34:32	151	21
☐ ✎ Ubah ⅔ Salin ⊖ Hapus	2020-06-26 07:34:53	125	37
☐ ✎ Ubah ⅔ Salin ⊖ Hapus	2020-06-26 07:35:30	152	1
☐ ✎ Ubah ⅔ Salin ⊖ Hapus	2020-06-26 07:35:31	155	1
☐ ✎ Ubah ⅔ Salin ⊖ Hapus	2020-06-26 07:35:32	155	62
☐ ✎ Ubah ⅔ Salin ⊖ Hapus	2020-06-26 07:36:34	155	2
☐ ✎ Ubah ⅔ Salin ⊖ Hapus	2020-06-26 07:36:36	153	1
☐ ✎ Ubah ⅔ Salin ⊖ Hapus	2020-06-26 07:36:37	152	1
☐ ✎ Ubah ⅔ Salin ⊖ Hapus	2020-06-26 07:36:38	164	2
☐ ✎ Ubah ⅔ Salin ⊖ Hapus	2020-06-26 07:36:40	152	1
☐ ✎ Ubah ⅔ Salin ⊖ Hapus	2020-06-26 07:36:41	155	2
☐ ✎ Ubah ⅔ Salin ⊖ Hapus	2020-06-26 07:36:43	152	2
☐ ✎ Ubah ⅔ Salin ⊖ Hapus	2020-06-26 07:36:45	153	61

>. Day 3 Ultrasonic Sensors for the second motorbike lane

Picture 9: Data for Second Motorbike Lanes Day Three

	waktu	tinggi_motor2	diffwaktu
☐ ✎ Ubah ⅔ Salin ⊖ Hapus	2020-06-26 07:36:37	163	1
☐ ✎ Ubah ⅔ Salin ⊖ Hapus	2020-06-26 07:36:38	169	2
☐ ✎ Ubah ⅔ Salin ⊖ Hapus	2020-06-26 07:36:40	170	1
☐ ✎ Ubah ⅔ Salin ⊖ Hapus	2020-06-26 07:36:41	171	1
☐ ✎ Ubah ⅔ Salin ⊖ Hapus	2020-06-26 07:36:42	152	485
☐ ✎ Ubah ⅔ Salin ⊖ Hapus	2020-06-26 07:44:47	157	1
☐ ✎ Ubah ⅔ Salin ⊖ Hapus	2020-06-26 07:44:48	164	1
☐ ✎ Ubah ⅔ Salin ⊖ Hapus	2020-06-26 07:44:49	161	1
☐ ✎ Ubah ⅔ Salin ⊖ Hapus	2020-06-26 07:44:50	161	2
☐ ✎ Ubah ⅔ Salin ⊖ Hapus	2020-06-26 07:44:52	166	2
☐ ✎ Ubah ⅔ Salin ⊖ Hapus	2020-06-26 07:44:54	167	176
☐ ✎ Ubah ⅔ Salin ⊖ Hapus	2020-06-26 07:47:50	158	1
☐ ✎ Ubah ⅔ Salin ⊖ Hapus	2020-06-26 07:47:51	177	1
☐ ✎ Ubah ⅔ Salin ⊖ Hapus	2020-06-26 07:47:52	156	11

4.2 Design

4.2.1 Ultrasonic Sensor design for cars and motorcycles testing

4.2.2 Prototype Gate of Soegijapranata Catholic University

4.2.3 Placement of Ultrasonic Sensors on motorcycle lanes

4.2.4 Arduino devices and ultrasonic sensors for car lanes at the exit gate