Bilkent University

Department of Computer Engineering

CS 432 - Machine-to-Machine (M2M) Systems

Project Proposal

SmartRoads by Smartifiers

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Contract

The road signs and speed limits are fixed in present-day structures. However, there may be situations where the speed limit must be changed according to the road and weather conditions. We can consider that there can be some road diversions due to heavy traffic or accidents then we can change the road signs accordingly if they are digitized. With our product, SmartRoads, traffic control will be easier and more efficient by dynamically adjusting the speed limit for that road. Traffic density will be detected by our product via computer vision. The optimal vehicle speed limit will be determined by measuring the air and road conditions such as temperature, air pressure and humidity of the area. The smart traffic signs that are adjusted according to this data will be displayed on the sign for the drivers. The product will be powered by solar energy. Drivers can also use an application to see the traffic density, road conditions anywhere on their phones.

We are going to sell the product for $250. Also, the collected anonymous data with our product can be used for advertisements and governmental statistics. In the light of machine learning processes, this data can be used to produce traffic density data which represents traffic bottleneck points according to season and weather conditions. For extra income, these points can be used for additional purposes such as advertisement boards near these points.

Our team will create a prototype of the product and present it to investors with the necessary details. Each member of the team has special responsibilities. We are responsible for software maintenance but hardware maintenance belongs to our investors. Our expectation from investors is to produce many of them and establish a product line. Also, investors can invest adequate money for us to establish a product line. Setup costs and labor are organized by our investors. During the development of a prototype, there can be additional costs. We require $100 for additional costs. Calculated equipment cost is roughly $165 per product. The engineering cost is $65 per product. We will also sell the collected data of traffic density, weather information and location data to related companies and advertising agencies.

In the event of a party's failure to perform its obligation, the other party may claim compensation for pecuniary and non-pecuniary damages. For the investor party, damages subject to compensation includes not being able to provide sufficient funding. For the investee

party, damages subject to compensation includes not being able to finish the project until the deadline or fail to develop a correctly functioning device. If the investee party fails to finish the project, the investee party will forfeit the intellectual rights of the project to the investor.

Team

Project name: SmartRoads
Team name: Smartifiers

Team target: The aim of the product is to reduce traffic jams and accidents. Nowadays, people suffer from traffic because of road conditions. Especially, when there are roads with a lack of proper signs at intercity roads. With smart traffic signs, traffic control will be easier and more efficient by dynamically adjusting the speed limit for that road. This product prevents waste of time on roads and provides safer roads. Users can track signs and road conditions with software application. The product will observe the roads and gather traffic density data via computer vision. The traffic data gathered from the devices can be used to determine which roads cars slow down or stop and can be sold to advertisers to decide where they should place the ads. Also, traffic service providers can also benefit from our collected data. The government can benefit from reducing damage cost which is caused by accidents. Also, the government can increase its country's traffic security level with our product.

Roles and Responsibilities

1 Project Leader & Architect

Team member: Elif Beril Şayli

The responsibilities of the project leader are related to business targets, financials, architecture, implementation, and testing plans. The project leader is responsible for why we choose this project and what its expected results. The project leader will determine business targets and make a research about market products that are similar to smart signs. Also, financials will be determined. The financials are the cost of equipment and employee cost. Therefore, financials can cause profit and loss. Return of investment will be calculated with net profit and cost of investment according to calculations and the analysis of this data will be done by the leader. Marketing strategies will be determined to increase the impact on a product by her. Therefore, project effort, cost, and schedule estimates will be done during projects. Moreover, the project leader identifies potential risks and makes plan risk management strategies. Schedule allocations and main activities will plan and reveal to team members. Diagrams which will be used to demonstrate these plans are Gantt Chart and Work Breakdown Structure. Also, a high-level architecture and implementation plan will be done at the beginning of the project by the project leader and architect. According to the product and implementation plan, testing styles and scenarios are determined by the project leader.

2 Hardware Specialist

Team member: Zafer Tan Çankırı

The responsibilities of the hardware specialist depend on the development of the hardware of the product. He will decide the type of air condition sensors and motion detectors are needed and which should be chosen with which purposes and trade-off decisions. He is going to decide which microcontroller should be used according to the requirements of the project and its sub-modules. He also needs to find a proper network connectivity solution to deliver the collected data to the cloud. He will also handle the connection of these sub-modules such as the sensors, communication modules, and the indicator lights with the microcontroller. He will choose a suitable powering solution for the product. He is also responsible for the development of the circuitry of the product and the designing of the mainboard, soldering the components and making the connections of the product.

3 Node Programmer

Team member: Erdem Ege Maraşlı

The programmer will study the properties of the microcontroller and the supported development languages by it. He will also implement the mechanisms for the microcontroller to communicate with the cloud over the network modules (with communication protocols such as HTTP/S). He will also handle getting the environmental data from the sensors and buffering of the sensor data and packetizing process of them. He will be responsible for the firmware updates of the nodes. He will develop an algorithm to create traffic sign shapes by the indicator lights on the project.

4 Integration & Server Side (GUI) programmer

Team member: Berkin İnan

The responsibilities of the Integration and Server Side programmer are developing a mobile app for the setup, a REST API for communicating with the devices and a web app that displays all the received from the devices in charts and graphs. A mobile app will be developed for the setup of the devices which will register each device to the server. Once the device is registered, its location data will be stored and the device will be marked on a map. A REST API will be used for receiving the data from the devices and the received data will be stored in a database. Then, the stored data will be processed into a human-understandable form to be displayed on a dashboard. The programmer will design a dashboard displaying the information for each device and the sensor data gathered from the devices. Weather conditions, traffic density and optimal vehicle speed for each location will be displayed with charts and tables.