



BUMPS**SENSE**

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I. EXECUTIVE SUMMARY

BUMPSENSE



COMPANY OVERVIEW

BUMPSENSE IS AN AUTOMATED ROAD INSPECTION DEVICE THAT SCANS ROAD SURFACES AND ALERTS THE DRIVER OF APPROACHING POTHOLES IN ORDER TO REDUCE RISKS AND DAMAGES ASSOCIATED WITH POOR ROAD CONDITIONS AND IMPROVE RIDE QUALITY.

PROBLEMS

- 1 ROAD CONDITIONS WORSEING
- 2 PASSENGER SAFETY
- 3 VEHICLE DAMAGE
- 4 VEHICLE REPAIR COSTS
- 5 CURRENT INEFFICIENT INSPECTION METHODS



SOLUTIONS

- 1 DETECTS APPROACHING POTHOLES FOR CONSUMER VEHICLES TO IMPROVE SAFETY AND REDUCE VEHICLE DAMAGES
- 2 INPUTS THE LOCATION OF POTHOLES ON AN APP TO ALERT OTHER DRIVERS IN THE SAME ROUTE
- 3 UTILIZES IMAGING TECHNOLOGY FOR BETTER ACCURACY
- 4 DATA CAN BE USED BY ROAD MAINTENANCE AND THE MUNICIPALITY FOR POTHOLE REPAIRS

CUSTOMER SEGEMENTS



CASUAL DRIVERS

Primary Market, Need to be Educated on the value of Bumpsense

AUTOMOBILE ENTHUSIASTS

Drive expensive Cars, Wealthy, Seek out Bumpsense to protect their cars

TRUCK PROFESSIONALS

Wealthy Truck Drivers, Buy in bulk to outfit their whole fleet with Bumpsense

UNIQUE VALUE PROPOSITION

ALERTS DRIVER OF APPROACHING POTHOLES

Drivers Are Given Sufficient Time To Change Lanes Or Adjust Their Speed

CAN BE USED BY ALL VEHICLES

Bumpsense Can Be Mounted On Busses, Trucks, Motorcycles, Cars

COST EFFECTIVE AND BETTER ACCURACY

Imaging technology provides better accuracy of upcoming potholes and Bumpsense is a more cost effective device compared to other road inspection devices.

CHANNELS

PRIMARY DISTRIBUTION CHANNEL: ONE-LEVEL

Appeals to Casual Drivers, as Dealerships can sell, advertise, and install Bumpsense

SECONDARY DISTRIBUTION CHANNEL: ZERO-LEVEL: DTC

Targets Automobile Enthusiasts, who research online, find Bumpsense, and can easily and conveniently purchase and use Bumpsense

PROMOTIONAL CHANNELS

Targets Operate booths at Automobile summits, hand out flyers/pamphlets at dealerships, and play commercials to educate and show the advantages of Bumpsense



CONCLUSION AND ROI

- **BUMPSENSE IS AFFORDABLE AND AVAILABLE FOR CONSUMERS**
- **INVESTMENT: \$400,000 FOR A 25% STAKE IN BUMPSENSE**
 - **GOES TOWARDS HIGH-QUALITY ADVERTISEMENTS AND SOFTWARE/APP DEVELOPMENT**
 - **ROI: 918% IN 5 YEARS WHICH IS \$3,672,000**

PROPOSED METRICS

1 SALES FROM WEBSITE V.S. SALES AT DEALSHIPS

2 CUSTOMER AQUISION COST: EXPECTED TO DECREASE OVER TIME



II: PROBLEM

Road infrastructure is a public asset that society relies heavily on and is a crucial component to the economic development of a nation. Unfortunately, due to weather conditions, inadequate maintenance, heavy traffic and age, it has resulted in road deterioration and the formation of potholes. Potholes are an emerging global issue affecting citizens due to unpleasant driving experiences, vehicle damage and vehicle accidents. The US has reported over 55 million potholes with 16 million drivers reporting damages caused by potholes in a 5 year span and over 2000 fatal vehicle accidents per year. In cold climates like Canada, the fluctuation in the temperature above and below the freezing point contributes to the severity of the development of potholes. Moisture from rain or snow can seep under the pavement, and when the temperature lowers, the volume of water freezes which results in upward pressure and the change in temperature can cause deformities in the pavement which results in potholes. In 2021, Toronto spent over 4.7 million in refilling just under 200,000 potholes. Despite the low cost of \$25 to repair each pothole, potholes cause billions of dollars in damage per year due to automobile wheels, tires and suspensions, and car accidents. Common issues from potholes for motor vehicles are sidewall bulges, hubcap detached, tread separation or punctures, wheel misalignment, damage to the rims, damaged suspension, etc. The Canadian Automobile Association has found that drivers are paying higher vehicle operating costs by about 3 billion annually due to potholes and road conditions. Vehicle owners are paying thousands in repairs and it is not preventable considering that driving at just 40km/h over a pothole could cause severe vehicle damage depending on the depth. Attempts to swerve around potholes are a major cause of accidents due to the short reaction time for the driver to check the surrounding traffic before shifting. Pothole damage may be covered under optional auto insurance policies, depending on the vehicle owner's coverage. It also depends on the extent of damage to the vehicle to file a claim for the damages from a pothole. Road conditions are worsening, and according to the World Health Organization, vehicle accidents will be the fifth leading cause of death by 2030. Potholes are currently being dealt with on a priority basis due to the utilization of manual inspection methods which often require human assistance which is time consuming, inefficient, and costly.

III: CUSTOMER SEGMENTS

The BumpSense customer base is categorized into "Casual Drivers", "Automobile Enthusiasts", and "Truck Professionals". Casual Drivers make up the majority of our customers and drive a budget to moderate end car, are between 35 and 70 years old, and have family or friends whom they would like to keep safe. They are not actively looking to protect their car, so will only buy BumpSense when a dealership recommends it to them, or they buy a used/new car, in which case BumpSense will come pre-installed through certain add-ons or upgrade packages. Car Enthusiasts are passionate about cars and know a lot about them, so thus own high-end luxury cars. They see the value in keeping their car scratch free, so they continuously seek out BumpSense for its ability to do just that. They can be split up into being 25 to 30 year olds who recently secured their first high-paying job or being 50 to 60 year olds who have accumulated wealth over time and can now fund their passion. This customer segment also includes motorcyclists, who are very passionate and affectionate to their vehicles as well. Lastly, the Truck Professionals customer segment looks at the Trucking industry. The trucking companies constantly experience damages due to potholes and other road obstructions, which affects their cargo, is expensive to repair, and ultimately reduces their profits. Trucking companies will see

the value in BumpSense, so will order many BumpSense Sensors in bulk, in order to outfit their whole fleet of trucks. BumpSense is focusing on growing and expanding within the North American market right now, so that BumpSense is polished and better ready for the Global Market, which will be entered in 5 years time. Due to potholes forming in high traffic areas that are cold and snowy, most BumpSense customers will reside in the cities — Toronto, New York, Nashville, Philadelphia, and Seattle.

IV: UNIQUE VALUE PROPOSITION

Potholes are inevitable, but vehicle damage and passenger injury are preventable. Bumpsense is an automated road inspection device attached to consumer vehicles that utilizes imaging technology to scan road surfaces and alert the driver of approaching potholes, reducing risks and damages associated with poor road conditions.

V: SOLUTIONS

BumpSense uses an Intel RealSense Depth Camera D455 equipped with a CCD line scan imaging sensor to detect upcoming potholes using depth variations from algorithms. The camera is a measuring application with 3D inspection and the CCD line scan image sensor uses a row of sensors to capture high resolution images of road surfaces as wide as 14.4 feet in one pass. Most cities utilize area scan cameras which only takes a single image of the road conditions, whereas a line scan camera takes hundreds of 1D images in a row and forms them into a 2D area which is more accurate. There are various other methods to detect potholes such as using vibrational technology, however it's accuracy is low as many false detections can occur such as when vehicles pass over manhole covers and speed bumps. Laser technology is highly precise and can detect potholes using a grid based processing approach, however the equipment is highly expensive and cannot be applied for a wide area for fast pothole detection. Our visual based method can scan a wide enough area and accurately detect potholes at a low cost. A potholes detection system using 2D images has already been created by Koch and Brilakis where they attached a webcam to a robot vehicle prototype around 60 cm above the ground and it was able to use 2D recognition and 3D reconstruction to measure the width, quantity and depth of potholes. We are introducing a new pothole detection system in which the camera collects images that provide information of the pothole including the location, size, appearance, depth, etc. This data is then stored in the pothole database and we will create a software that analyzes these 2D images of the area and retrieves pieces of information including the type of road, latitude, shape, size, depth, collected date, lane number of road, etc. If a certain number of conditions are met based on the scan of the image by the software, the collected GPS data from the CCD line scanner will be sent to the BumpSense app and the location of the pothole will be visualized as a dot on the digital map. The app will then alert drivers of upcoming potholes using subtle beeping sounds or using notifications to provide sufficient time for the driver to slow down or change lanes. The implementation of the app could improve the rate at which potholes are fixed as multiple vehicles travel the same road and each vehicle with the BumpSense device will detect the pothole. This also lowers the amount of vehicles from encountering damages from emerging potholes. The data obtained from the app can be used by road maintenance officials and the municipal government as multiple detections indicate areas that require immediate fixings. It also improves road maintenance repairs as rather than having the workers scan each road, the utilization of community input and the analysis of the device will be a more efficient solution at filling potholes. This innovation is useful for accident prevention and lowers the

probability of collisions and thus lowers the risk of injuries and prevents fatality. This device also provides drivers with a more comfortable travel with a smoother ride from less load defects and reduces the costs of damages for vehicle owners. Overtime, future advancements will be added including the app providing the user with alternative routes to reach their destination based on the number of potholes that were detected by vehicles traveling the same route. The software will also have a feature where it can provide a rough estimate of the cost to repair the pothole that is detected which can be used by road maintenance officials. Overall, we strongly believe that our proposed system can detect potholes accurately in real time and improve road safety and transportation efficiency.

VI: CHANNELS

BumpSense's use of both a one-level and zero-level distribution channel allows us to better appeal to the needs, values, and intents of our customer base. Our primary distribution channel has one-level of middlemen, as Bumpsense goes from our manufacturing facility, to the car dealerships (retailer), and finally to the end consumer. This distribution channel appeals to the needs of a Casual Driver, as the car dealerships will offer testing demonstrations, installation services, and include Bumpsense as a vehicle upgrade and within enhancement packages. This will show Casual Drivers the importance of Bumpsense and the installation services and packages will make it very easy to add Bumpsense to their new, used, or existing car. As well, to better incentivize dealerships to promote BumpSense, we will give them 30% of total product sales and 90% of service-related sales such as BumpSense vehicle installation. In the zero-level, secondary distribution channel, BumpSense customers order our sensors online, which are immediately shipped from our manufacturing facility, straight to the customer's door. This distribution channel targets our automobile enthusiasts customer segment, who conduct online research for protecting their car, so will come across BumpSense and can easily order and take advantage of our pothole sensor. The included installation kit will give consumers a simple and quick way to install BumpSense on their own vehicle. Furthermore, this zero-level distribution channel is direct to consumer (DTC), so it will reach the consumer fast and will save us money as it cuts out unnecessary middlemen. Using a combination of our two distribution channels, bulk orders placed by our truck professionals customer segment are fulfilled. Our manufacturing facility will ship these large sensor orders to a dealership close to the truck company. The dealership will send mechanics to the truck company, who will then install the Bumpsense sensors over there, as that will be much easier and more convenient than having the Trucks come to the dealership. The operation of both our primary and secondary distribution channels increases our customer base and maximizes both our efficiency and effectiveness. It majorly contributes to the success of Bumpsense as a whole, creating opportunities to expand, develop, and grow into the long-lasting future.

The 3 aspects of Bumpsense's promotional channels expand our outreach, growing our customer base. First, we set up booths to promote our product at automobile events such as at the Canadian Automobile Association (CAA) Summit. This gives Bumpsense a strong reputation and great exposure within the automobile scene, giving customers a sense of trust and reliability, making them more inclined to purchase Bumpsense. Second, through flyers and pamphlets at dealerships, as well as being featured on the automobile manufactures websites, our "casual drivers" target market will become more familiar with Bumpsense. Third, commercials and

advertisements will be used to introduce new customers and educate them on the immense benefits of BumpSense.

VII: REVENUE STREAMS

The company is to earn revenue simply from the sale of Bumpsense at the local car dealerships all over the GTA. Each unit is sold for \$399, and the price in making the product is roughly \$200. This will make a net profit of \$199 and hence, provide a net profit of around 50% per unit sold. The business model is stretched across several revenue streams for vast customer preferences. Using such revenue streams to strategize, and overall understand the market's tendency of purchasing products from Bumpsense. Channel Distribution: Explained in the table below is the projected revenue of the first year revenue. Using the method of channel distribution, the product is initially going to be distributed all across the GTA car dealership, so it will be limited to the consumers surrounding the parameters. The physical distribution will give us a chance to get customer feedback in-person and incorporate those solutions into our device. At Bumpsense, we also provide a subscription plan for recurring revenue which is solely surrounded across information technology. Due to the large variety of variables including, weather conditions like fog and snow, traffic conditions or unexpected road obstacles; the decision to make changes to the software is crucial with a seasonal or yearly update. We expect to provide seasonal software updates to add features like (making potholes show up on navigation systems) navigation, weather detection, traffic detection, terrain detection, etc. The consumers who wish to purchase these services must pay \$49.99 every 12 months. Due to the immense need of pothole detectors in the GTA market, it is clear that we will have returning customers to purchase these devices for other vehicles they own. For customers the average customer/person will likely buy around 4 cars in their lifetime. Therefore, they will likely use BumpSense for all the cars they have after they see its immense value.

Year One Projected Revenue:

	Price Per Unit	Cost Per Unit	Units Sold	Sales Revenue	Profit
Channel Revenue (through car dealerships)	\$399	\$240	500	\$199500	\$79500
Subscription Revenue	\$49 Per Year	\$9 Per year	50	\$2450	\$2000

Revenue and Profits By Year:

	Year 1	Year 2	Year 3	Year 4	Year 5
Units Sold	500	900	1500	2600	5050
Subscription Units Sold	50	95	190	300	700
Revenue	\$201950	\$363755	\$607810	\$1052100	\$2049250
Net Income	\$81500	\$146900	\$246100	\$425400	\$830950

Therefore, BumpSense will continue to expand its marketing and distribution reach, giving for fast, profitable growth year by year.

VIII: COST STRUCTURE

Customer Acquisition Costs: BumpSense will spend \$10,500 on promotional and distributional activities to acquire more customers. As a start-up company, we are expected to present ourselves to create more excellent customer value. To do so, we must apply pressure on marketing. More specifically, regarding advertisements, we have decided to place booths at exhibitions, which will cost us \$1000, flyers and pamphlets, which will cost us \$1500, and commercials, which will cost us \$7500. Regarding packaging, it is crucial to think twice about costs because online shipping companies cover the natural packaging we apply before sending it out. Not only did this, we decided to keep the packaging low in price but still quality effective as we understand to meet the level in every sales sector. Shipping cost depends on the distance, location, and time of delivery. Hence, we have decided to meet ends at \$5000 for total advertising spending for the year.

Customer Acquisition Costs (CAC) by year, based on the marketing budget and the projected amount of new customers:

	Year 1	Year 2	Year 3	Year 4	Year 5
Units Sold	500	900	1500	2600	5050
New Customers	500	880	1460	2550	4960
Marketing Budget/ Spending	10000	18000	23000	25000	27000

CAC	20.00\$	20.45\$	15.75\$	9.80\$	5.44\$
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Distribution Costs: The product we are managing and selling is very high in quality. Intel sells each unit for \$412. However, we were able to acquire a 40% discount due to the bulk purchase of 500 units for \$240 each. Therefore, we plan to sell to local car dealerships at a 30% marginal increase. We aim to get the product across and build a more prominent name for BumpSense. Therefore, we plan to use these giant retailers for an upwards slope in reputation and numbers. The rest of the sales are intended to be through direct online shipment. It is vital to increase the profit margins to 40%, as in B- to C distribution. Shipment is also a factor in logistics, so the cost to sell must be higher.

Human Resources and Projected Costs:

Employee Name	Position	Total Salary per/ year	Expected no.of hours of work
Briana	Programmer	\$60,000	40 hrs
Jeff	Logistics Officer	\$55,000	40hrs
Sebastian	Warehouse Supervisor	\$55,000	40hrs
Kayla	Accountant	\$35,000	40 hrs
Liam	Warehouse Associate	\$35,000	40 hrs

For the betterment and positive growth of the company, we have decided to appoint five employees in total: Briana, the programmer who takes care of the software updates. Since the product is brand new, it would only need a few updates during the starting 2-3 years, so one employee is sufficient. Jeff, taking care of the logistics, will be responsible for the distribution and equipment. An accountant manages the debits and credits, receivables and payables, purchases, and all the sales. We also employed two people for the physical strength work, including machine- work, infrastructure, and completing the miscellaneous jobs here and there.

We plan to rent a warehouse storage space for all the initial stock before and during the sales process. The cost of a 10 X 20 warehouse capacity is \$344/ monthly, \$4128/ yearly, eventually leading to over \$450/ monthly, \$5400/ yearly due to maintenance and miscellaneous costs.

IX: KEY METRICS

By measuring 2 specific key metrics, we can ensure that BumpSense is growing as a company and that all the aspects of our business are working and doing well.

- 1) Sales from Website VS Sales at Dealerships: Indicates which distribution channel to focus on. We are currently prioritizing our one-level, manufacturer to dealership to consumer distribution channel, as it targets and appeals to our primary market of “Casual Drivers”.
- 2) Customer Acquisition Cost (CAC) : Signifies whether our marketing efforts are effectively bringing in new customers. We expect the CAC to be high at \$20 during the start/growth phase of our business, but it will decrease to 5.44\$ within 5 years time, as more people find out about BumpSense, and the benefits of BumpSense spread through word of mouth.

X: COMPETITIVE ADVANTAGE

The development of our automated road inspection device for consumer vehicles is a unique product in the market as it can simply be purchased, attached and used by any vehicle. Many of the newer vehicle models are being equipped with pothole detection softwares to warn drivers, manufacturing companies include Tesla, Mercedes, Ford, Jaguar, etc. However, this software and pothole detection features are not available to car models later than 2016 and is a feature that is currently only available for certain car companies. Bumpsense is a product that can be attached to any vehicle without hardwiring or installation fees, this product avoids hassle by simply being mounted at the lip above the vehicle’s license plate. The product is placed systemically at the front of the vehicle to avoid taking away the aesthetics of the car but also at a sufficient height to be able to detect approaching potholes from a distance and avoid external damages. The product is also more accessible for different vehicles as it can be attached to older cars, buses, trucks, motorcycles, etc. Bumpsense strives to encompass the needs of all vehicle owners and improve public safety for society as a whole. Bumpsense is an affordable product and is a cheaper alternative to paying the repair costs from pothole damage, as according to the Canadian Automobile Association, the average cost of repairing pothole damage for a vehicle can be around \$300 to over \$1000. Although there are existing devices that can perform the same function with a similar degree of accuracy, the devices are more complicated as it utilizes machine learning, accelerometers, and gyroscopes to analyze the depth detection patterns. Bumpsense is a more simplistic product that utilizes depth sensors and imaging technology to provide the most accurate detections of potholes in a shorter duration of time. Pothole detection devices available are large in size and require it to be mounted to the roof, however Bump Sense is a more compact and lightweight product that can be mounted in the front of the car due to less area required. Also the devices for pothole detections are currently not available to the public and are only used by road maintenance officials. For example, Durham Region uses Rover AI Pothole Detection to scan roadways and log data in the cloud for improving the rate of filling potholes. Bumpsense’s app is available to both road maintenance and the public which helps reduce the risks for road users, as well as improving road infrastructure. Bumpsense is a futuristic technology that enables drivers to avoid the potholes within reach and improve safety globally.

XI: CONCLUSION

Based on our projected revenue and the costs for implementation of new features, BumpSense is seeking \$400 thousand for a 25% stake in our company, valuing our company at \$2 million. The majority of this money, at \$200 thousand, will go towards the software side of our business. We will hire more programmers and software engineers, who will work on the subscription model and creating useful software updates. Another \$100 thousand will go towards our advertising and marketing efforts, where we will focus on creating higher quality commercials and on displaying them to a higher number of people. The remaining \$100 thousand will be used for optimizing our manufacturing line and distribution channels. This is because our primary market is Casual Drivers, and to engage and unlock the potential of this segment, we must focus on educating them about the use and importance of driving with Bumpsense, which will be done through a great, well-produced commercial.

Company Value and Return on Investment (ROI) based on a \$400 thousand for 25% stake investment Bumpsense:

	Year 1	Year 2	Year 3	Year 4	Year 5
Company Value	\$1.6 Million	\$2.9 Million	\$4.8 Million	\$7.1 Million	\$16.3 Million
ROI	0%	81%	200%	343%	918%

By doing this investment with BumpSense, we guarantee an exceptional return on investment and will help the billions of people who face life threatening damages due to potholes and poor road conditions.

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