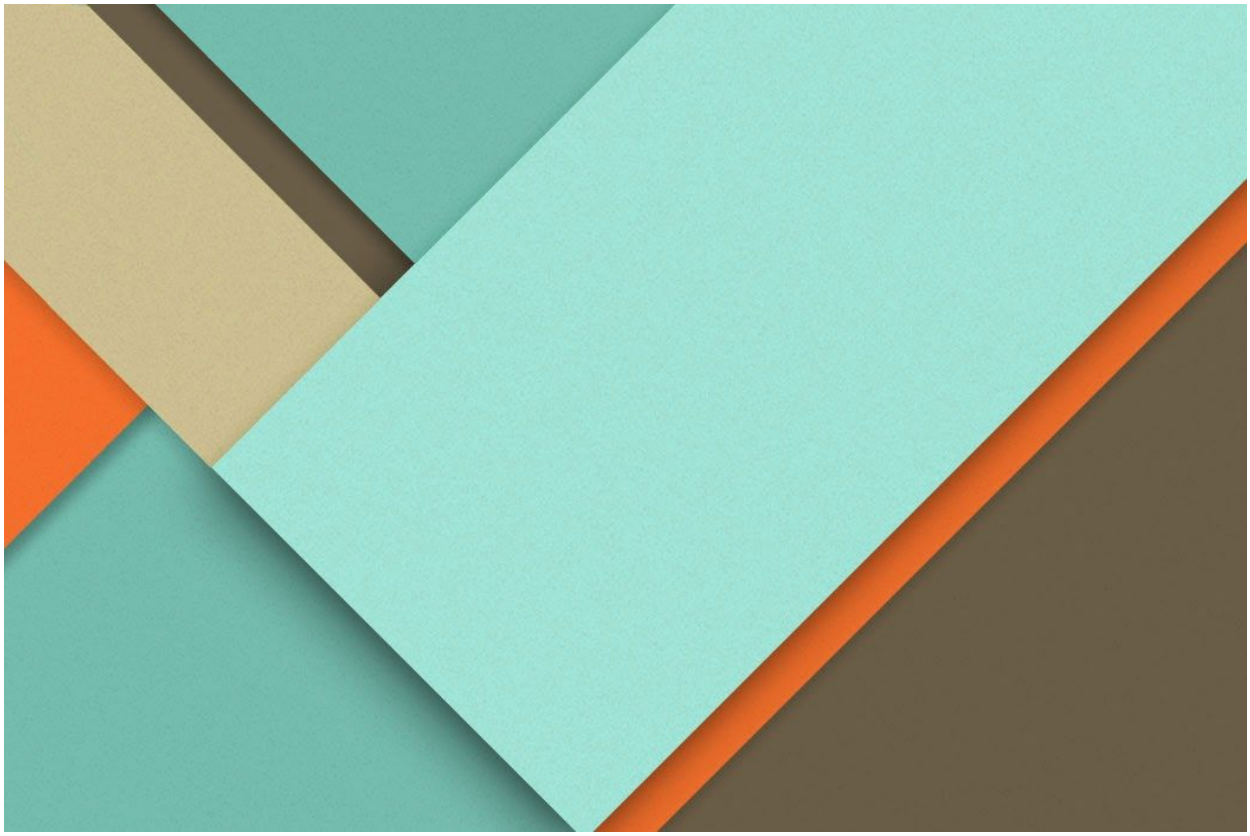


Project Proposal

17.10.2020

McDefect Solutions -

Chinmay Naik | Chinmay VG | Tezan Sahu | Suchit Sharma | Ayush Pandey

203190016 | 193109018 | 170100035 | 170040041 | 193300007

IIT Bombay

Company Name

McDefect Solutions

The name has been derived from the service the company provides i.e., AI solutions for the detection of mechanical (short as Mc) defects.

Company Tagline

" Supporting you, defect-by-defect "

The idea behind the tagline was to have a short and catchy phrase with a certain poetic rhythm to it and giving an idea of the purpose served by the company.

Problem Statement

I. India ranks 3rd in global manufacturing locations in the world and production of the basic metal is the highest contributor in the GDP of the manufacturing industry, (i.e. about 11%). In 2016, PM Narendra Modi started an initiative "***Zero defect zero effect***" aimed at reducing the defects in manufacturing as well as ecological effects. Even though the initiative saw a good start, it hasn't achieved enough success as the decrease in defects dropped after a couple of years.
II. The major reason for this was no new technological change in identifying defects in the early stage of the manufacturing i.e., the raw material production stage (billets, pipes, sheets, slabs, etc.).
III. To reduce wastage and save time and manual effort, we need to automate defect detection and integrate with existing processes and facilities. Customers also need the technique to detect defects with high accuracy.

Solution Statement

I. Develop AI-powered defect detection & classification solutions for industries that cater to the initial stages of manufacturing, using transfer learning by training it for different processes (like casting, rolling, etc.), gaining knowledge from one, and applying it to other processes.
II. This will automate the detection, improve the efficiency of the production, and most importantly, it will provide a boost to the manufacturing industry economically.

Business Case

I. **Strategic context**: Tapping the defect detection in early stages of manufacturing processes (like casting, rolling, etc.) using Convolutional Neural Network to save time and efforts, improve process efficiency and reduce wastage (thus, reducing costs) for customers.

II. **Economic analysis**: Return on the usage of services provided on API to the manufacturing company.

III. **Commercial approach**: Datasets are collected from the specified company for the process and then the model is trained on it.

IV. **Financial case**: Since it is a technological solution, no large investments are required. Initial datasets to train models are available for free. Thus, affordability is not an issue here.

V. **Management approach**: For roles and responsibilities, refer to RASIC + GANTT chart. New developments/updates in API will be made in later stages to improve the products from customer perspective + services and attract more customers.

VI. **Risk analysis:** The following are some key risks-

   A. Initial trust by the manufacturing industry on technological solutions.

   B. Dataset compatibility with the model and/or API integration with the existing structure of the company might fail.

Market Survey

Lincode Labs	Scortex	Inspekto
• US based startup • Automotive, Electronics, Pharmaceuticals, Materials & Packaging • Captures microscopic defects • Future work: Predict machine downtime, likelihood of future defects • https://lincode.ai/	• Primarily in Europe • Inspection & Monitoring solutions • Automotive, Aeronautics, Luxury items and Consumer Goods • https://scortex.io/	• Israel & Germany (Europe) • Autonomous Machine Vision solutions form QA • Caters to Automotive, large-scale equipment, etc. • https://inspekto.com/

Key Differentiator

I. The market segment that we are targeting is specifically the companies involved in the initial stages of manufacturing with processes like casting, rolling, etc.
II. Providing Image-based solutions as well as real-time video solutions.

Unique Selling Point (USP) & Protection

Detecting macroscopic defects in "*early-stage manufacturing processes*" and classifying them, while also suggesting possible reasons.

Protection:

I. Proprietary encryption of model(s) & use of hardware credentials for verification
II. Code obfuscation
III. Software Patent filing for our model & algorithms

Barrier to Entry

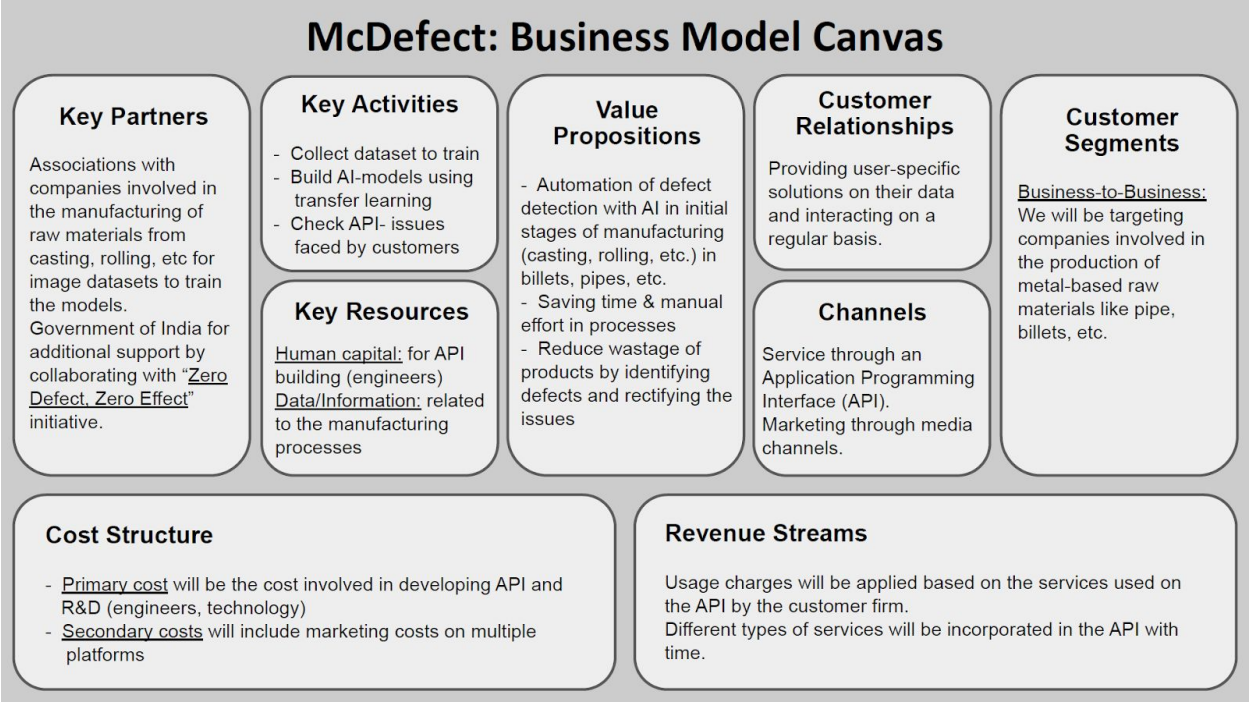
By us:

I. Amount of data possessed by giants like Google, Amazon, etc
II. Lack of capital investment (from the perspective of the project) => lack of exposure to proprietary models (which may perform better than open models)
III. Availability of annotated data (with details about the location of defects for localization purposes): A large number of manual efforts will be invested to localize defects & make bounding boxes around them for images provided by the industry (if we want to pinpoint the location of the defect)

By others:

I. Employees worry about [fear] Artificial Intelligence jeopardizing job security
    A. Foster a digital culture and augment your staff with innovation
    B. Consider the idea of augmented intelligence, instead of deploying AI to replace your staff, consider using it to "*amplify* their capabilities."
II. Cultural barriers [resistance to change]: company stakeholders are not convinced about the need for AI in particular, and they lack a proper understanding of the related benefits
III. Initial friction moving from well-established quality monitoring systems to the computer vision-based approach that we try to bring in

Business Model Canvas



Technology Landscape Assessment

I. Patents

A. Unified neural network for defect detection and classification in semi-conductors
B. Training a machine learning model with synthetic images

II. Published Literature

A. Detection and Segmentation of Manufacturing Defects with Convolutional Neural Networks and Transfer Learning
B. Defect Detection in Porcelain Industry based on Deep Learning Techniques
C. Automatic localization of casting defects with convolutional neural networks

III. Open Libraries

A. OpenCV
B. Keras / PyTorch
C. PIL (pillow)
D. Statsmodel
E. Scikitlearn (confusion matrices, etc.)

IV. Proprietary Libraries

None Available.