# Title slide (0:15):

* Good morning, welcome to today’s discussion on ethical AI project development.
* Today we will be discussing how AI can bring optometry to large, underserved populations by leveraging inexpensive and readily available technology.

# An idea for good (Background & market) (2:05):

## **Our Project Idea – Explanation of the overall process**

* The motivation for this project is as follows:
* In many developing countries, millions suffer from blindness due to lack of diagnosis and testing, all while the vast majority of such eye-related illnesses are entirely preventable.
* The system currently used in developed countries of manual screening is not a practical solution as it cannot scale and requires both 1) expensive sophisticated equipment and 2) trained on-site optometrists.
* Our AI based innovation uses smartphones and an inexpensive optical lens attachment to conduct fully automated eye exams to detect eye diseases in fewer than 5 minutes.
* ~~Our distribution/implementation strategy is based on partnership with thousands of community health centers run by UNICEF. The local medical staff will be trained online via zoom sessions and teach-in videos on how to use the technology.~~
* ~~Our predictive model is a deep neural network system that was trained using over 200,000 eye disease images and tested over 50,000 reserved images, the final model achieved an accuracy in excess of 90%.~~
* ~~Furthermore, we partnered with Toronto General Hospital for Clinical Trials using over 1000 volunteers for eye tests using both conventional high-precision retinal machines and our software with over 99% consistency, resulting in Patents and FDA approval.~~
* The AI system predicts the eye condition of the patient and provides results of vision tests. Moreover, using tele-optometry in case of critical conditions images are sent to licensed optometrist within our partner network via charitable eye hospitals.
* Based on the reports from licensed optometrist, patients are referred to central tertiary hospitals in the country for further treatments.

**Market Size and Competitive Position**

* The market for AI in healthcare is estimated to be worth 62Bn $ globally by 2028.
* Largely due to fast-growing volume of medical data generated by current healthcare systems.
* Cost reduction will be a major driver of AI adoption as traditional healthcare systems struggle to cope with ever increasing costs of providing care.
* ~~Currently AI applications are focused on Diagnostic Imaging, Radiation Therapy, and Hearing Aids – these areas have successful AI processes in place all ready.~~
* ~~We believe that eye exams are the next area of medical treatment suitable for AI technology.~~

# Research process and privacy considerations (1:45):

**Evidence of Research**

* Research conducted on use of AI to detect eye diseases proves that AI based eye-exams can be safe and effective in real world.
* ~~AI based eye-exams offer easy-to-use, automated tool for medical practitioners to address growing need for automated screening and monitoring of patients.~~
* Empirical research done with over 100,000 patients showed over 91% accuracy.
* The research also showed that AI based eye-exams offer cost and time benefits over legacy manual systems.

**Partnership with Health Organizations – Value Creation for both parties**

* We plan to partner with large government hospital as it offers value for both parties. We retain the requisite model training data, and the hospital gets early exposure to cost-reduction technology.
* ~~Meanwhile, our technology offers tremendous value to governments and large hospitals as AI based testing is ~80% lower in terms of costs and time savings~~
* Most large public sector hospitals have ESG budgets for health care efforts in developing markets. ~~Our technology can help provide eye-care for much larger population in Africa with fraction of the cost.~~
* Moreover, the millions of test conducted using our system will provide R&D statistics for public sector research hospitals on anonymized basis

**Data Privacy Considerations**

* We still use meaningful consent from patients and explain which information will be used in anonymized manner by 1) whom 2) under what circumstances 3) for what purpose.
* ~~Patients will maintain the option to opt out at any time.~~
* We will use industry best practice for de-identification and anonymization of data using Safe Harbor Standards
* We will remove personal identifiers from medical record data which make it difficult for any party to re-create a link to individuals albeit keeping analytical effectiveness of data
* We will not collect any unnecessary data (geographic or socio-economic).
* ~~We will not capture any secondary device or cookies data from the patients~~

# Requirements gathering and design (0:45):

* Stakeholder identification is a key step in a project such as this, where multiple formal and informal organizations are active.
* Being more engaged with stakeholders will allow us to identify and respond to otherwise opaque barriers such as local health requirements, or patient accessibility needs.
* Since a key commodity in completing this kind of project is data, we can also leverage our stakeholder network to identify any existing regional datasets.
* Ultimately, individuals with lived experience in these markets will provide us the best visibility into our the environment we’ll be deploying into.

# Minimum viable product (1:00):

* Parallel to stakeholder identification, development of a minimum viable product will be progressing.
* Developing a product such as this will require several sequential components, starting with procurement of model training data.
* Since this data can be swapped-out for more representative data once the machinery of the algorithm is in place, the expediency of using data from developed countries takes hold here, while acknowledging and documenting the likely presence of a bias in the data.
* The remaining components are hardware and software; the former would comprise of inexpensive lens attachments for popular smartphones, and the latter would be a software platform to run on the smartphones.
* Since the device and software will be operated by local technicians with minimal training, the user interface of the software should be intuitive and contain support for local languages.
* ~~Software usability testing could be done both among developers and among stakeholders in the target market.~~

# Data procurement & financing (1:30):

* Now to dig a bit deeper into two major constraints on this project: Procurement of adequate training data, and procurement of project financing.
* Since this project will involve using an AI/ML algo to identify eye conditions, we will first need empirical data for the model to learn from.
* As discussed earlier, the greatest availability of structured optometry data will be among developed countries.
* And in any case, medical data of all forms is highly sensitive and typically difficult to export for commercial use.
* Our solution to this is to compress and anonymize the data at its source, thus removing confidential information and reducing the detailed medical file to only a small number of quantitative features.
* ~~This will reduce the sensitivity of the initial training data and allow for easier management around developed countries’ medical data privacy laws.~~
* And the next constraint is funding: we will likely be tapping conventional venture capital and start-up funding channels .
* However, specific nature of this project likely grants access to philanthropic and government grants which likely provide favourable financing conditions.

# Product development (0:45):

* Now that specifics have been discussed, lets bring it all together into concrete plans for the project’s development and implementation.
* The development of this project – that is – bringing it from inception to first trials, will be conducted in three phases:
  + The first will comprise largely of building a vendor network, sorting out data procurement, and connecting with local stakeholders.
  + The second will be a more inward-looking stage of model training and software development.
  + And the third will comprise of the formalization of developed solutions, and various regulatory approvals. At this stage, the product will be ready for its pilot deployment.

# Product implementation (1:05):

* Which brings us to our implementation plan: This will be spread across two phases.
* The first is the pilot project where the software and hardware combination will be deployed in the target market, but only in a small sample of 10 sites.
* The purpose of this stage is to examine how well the model performs in the real world, whether local patients are accepting of the technology, and how well the technicians are able to use the software.
* Further, this stage will provide for valuable target market data to further enhance the model’s performance, and also to quantify the value of bias in the original training data.
* Following 12 months of the pilot project, the product will be rolled out to the full target market.
* Contracts will be established with large care providers and fees will be calculated at the test level.
* Further, the fees charged will be different across clients -- commercial clients will pay more per use than NGOs and clients is severely underserved countries.

# Ethical concerns (1:10):

* And finally to lay the foundation for our ethical review, we have identified three possible ethical concerns with this current plan:
* The first pertains to data on which the initial model is trained; as discussed earlier, the initial training of the model would be done with data collected from medical centres in developed countries.
* This data would come from demographics significantly different from those where the model is being deployed.
* Thus a model training bias could result in poorly tuned diagnoses in the target market.
* The second pertains to the fact that we will be selling the product to distributors, rather than final clients.
* This means that we will have the responsibility to ensure that these distributors share our values of equitable access to health care, and that they pass on any concessionary pricing they receive.
* And the third pertains to the duty we will have to safeguard any sensitive individual data we handle at any time; both to make sure that the anonymization process is robust and that our custodial practices are up to industry standard.