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What is the title of your vision statement?

Engineering a Clean Water Future

What is your name?

Mark McEwan

What is your ONID username?

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What world problem are you concerned about?

Many people in developing countries do not have reliable access to clean water. Clean water is a basic human need, however there are too many areas in the world where water shortages exist. 11 percent of the global population does not have access to an improved source of drinking water such as household connections, public standpipes, boreholes, protected dug wells, protected springs and rainwater collections. The problem is exacerbated in developing countries. For example, in sub-Saharan Africa, over 40 percent of the population does not have access to clean drinking water. [1]

In 2010, the United Nations General Assembly officially recognized that human right to water and sanitation [1], and there are numerous efforts in progress to help solve this global crisis. However, the global water shortage is expected to worsen as the world population continues to increase.

It is critical that we understand, respond to, and promote demand for improved water quality and sanitation in developing countries. Without identifying why and how users would like improved services and subsidizing improvements without user input, many projects risk being abandoned or misused. We need to provide alternative methods to assist people in regions and communities that desire improvements. [2]

What is one statistic or quote showing that this is a major problem?

“783 million people do not have access to clean water and almost 2.5 billion do not have access to adequate sanitation.” [3]

“As a direct consequence 1.6 million people die every year from diseases attributable to lack of access to safe drinking water and basic sanitation and 90% of these are children under 5, mostly in developing countries. [4] UNICEF estimates that over 2,000 children under five die every day from diarrheal diseases, the vast majority of which are linked to inadequate water and sanitation.” [5]

“The United Nations estimates that Sub-Saharan Africa alone loses 40 billion hours per year collecting water. With much of one's day already consumed by meeting basic needs, there isn't time for much else. The hours lost to gathering water are often the difference between time to do a trade and earn a living and not. Just think of all the things you would miss if you had to take three hours out each day to get water.

When a water solution is put into place, sustainable agriculture is possible. Children get back to school instead of collecting dirty water all day, or being sick from waterborne illnesses. Parents find more time to care for their families, expand minimal farming to sustainable levels, and even run small businesses.

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The social and economic effects caused by a lack of clean water are often the highest priorities of African communities when they speak of their own development. The World Health Organization has shown this in economic terms: For every $1.00 invested in water and sanitation, there is an economic return of between $3.00 and $34.00" [6]

What is one anecdote about how this problem might possibly play out in real life for somebody?

Suppose a young child does not have access to clean water. Because of this, they stand a much greater risk of death and disease, and are much more likely to die before they are adults. Gastrointestinal diseases are the third biggest killer of children under five in sub-Saharan Africa and the second biggest killer worldwide. [7] In addition, children often spend hours each day collecting water for their families. This prohibits them from attending school, robbing them of an education.

Within this world problem, what is one sub-problem that bothers you?

Lack of clean water is especially prevalent in rural areas because infrastructure is too expensive to build, there are not enough people with the education or skills needed to design and construct clean water sources, and people in rural areas have to travel much further to obtain clean water.

What is one quote illustrating that this sub-problem is important?

A key problem plaguing rural areas specifically is that they are not using the proper approach that's suited to their location. In urban areas, where population density is higher, the cost of providing water is typically lower than for rural areas. The higher costs in rural areas often lead to rural water schemes becoming unsustainable. [8]

What is one anecdote about how this sub-problem might possibly play out in real life for somebody?

Suppose a rural village in Africa does not have access to clean water, the nearest source of clean water is miles away, none of the villagers have knowledge or skills to determine the best approach for solving their particular location's water issues, and the village itself is unable to fund a private company to help alleviate the problem. Women and children are especially impacted because they are the water gatherers for their community. They often have to spend many hours a day finding and transporting water. Without help from a non-profit organization, volunteers, or aid from other countries, there is not much this village can do to ease access to clean water.

What is a second anecdote about how this sub-problem might possibly play out in real life?

The lack of clean water in a rural village results in poorer hygiene of the residents and limitations on economic development for the community as a whole. According to WaterAid.org, "lack of water, sanitation and hygiene costs Sub-Saharan African countries more in lost GDP than the entire continent gets in development aid." [7] Unfortunately, poor hygiene and limitations on economic development only intensify the village's need for outside assistance. Without that, the chance that villagers are able to break out of the cycle of poverty is very small.

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What is one possible software system that could help to solve this problem?

A possible software system that could help solve this problem is a web platform that connects people with skills or occupations (engineer, teacher, doctor, geologist, project manager, etc.) who are willing to donate their time and skills with areas of the world that need assistance getting clean, sustainable water. The system would provide repositories for volunteers and specific areas that need assistance, would perform intelligent volunteer to region matching, would facilitate discussion of potential solutions, and communicate information such as dates, location, items to bring, etc. to the volunteers.

What are the three most important features that this helpful software system should have?

Databases of volunteer profiles, specific regions/areas in the world lacking clean water and their needed expertise(s).

A communication interface that allows volunteers to express interest in opportunities that interest them, and once matched, communicate with other volunteers they will be working with.

An algorithm that finds the best volunteer-to-region matches based on criteria such as expertise, distance, time commitment, etc.

For the 1st of these three features, why is this feature important?

A database of volunteer profiles, of regions of the world that require assistance obtaining access to clean water, and the specific needs of each region is important because we need data for the algorithm to crawl so we can efficiently match participants with volunteer opportunities to maximize success of the initiative. The organizational structure of this data is strongly correlated to the efficiency of the matching algorithm.

What is some sort of hypothetical example about how a person would use the 1st feature?

Suppose a mechanical engineer wants to volunteer their time and expertise to help others in need. The engineer could use this system to create volunteer profile listing his or her areas of expertise, languages spoken, regions of the world they'd be willing to travel to, time commitment they would be able to provide, etc. Once the engineer creates his or her profile, our algorithm would match them with suggested volunteer opportunities that they could express interest in joining.

For the 2nd of these three features, why is this feature important?

A communication interface is important because we need a way for people willing to volunteer to express interest in specific initiatives, ask questions, plan for the functions they will be performing on their mission, and get to know the others volunteers that they will be working with.

What is some sort of hypothetical example about how a person would use the 2nd feature?

Suppose a mechanical engineer may have volunteered his time to design an improved latrine system for a village in Ghana. He probably wants to know if he has been matched with other engineers or what other types of volunteers as well as their areas of expertise. The communication interface will allow the engineer to get to know his fellow volunteers, design initial plans to improve access to clean water by building an improved latrine system, gain information about the region he will be volunteering in (Ghana), and their unique challenges preventing them from access to clean water.

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For the 3rd of these three features, why is this feature important?

An algorithm that finds the best volunteer-to-region matches based on criteria such as expertise, distance, time commitment, etc. is important because we want the system to be both efficient and intelligent when creating matches. The algorithm will assess the above volunteer criteria and calculate weighted "scores" for each aspect by matching the volunteer information with information on the areas in need. The goal of the algorithm is to ensure the best change of volunteer success in improving water quality in their assigned region.

What is some sort of hypothetical example about how a person would use the 3rd feature?

A person wouldn't specifically use the algorithm, it would just run on demand when given inputs and output relevant matches. However, suppose our engineer created his volunteer profile on our system. Once the profile is received, it is passed to the algorithm which assesses his expertise (engineer, 10+ years of experience), distance from region (engineer resides in Boston, MA), time commitment (two weeks), and any region preferences the engineer has (wants to volunteer somewhere rural). The algorithm would input that data, compare each characteristic against each of the regions needing volunteers, and assign each characteristic a score. Higher scores mean that the volunteer is better suited than average for a specific region and is more likely to succeed. Lower scores mean that the volunteer is less likely to succeed in that specific region. The algorithm then returns the regions that the engineer scored highest on as his or her "suggested" regions to volunteer. The engineer then can express interest in a specific volunteer opportunity of their choosing.

Which of these three features is most important? Which is least important/optional? Why?

The algorithm used to match volunteers with areas in need is the most important because it is what separates this system from other clean water initiatives. This removes the need for a third-party to invest time in getting to know volunteers and their areas of expertise. The platform would still need an administrative team to identify volunteer opportunities and their specific needs and add them to the database but it would be mostly self-sufficient.

The communication interface is probably optional because there are numerous other methods for communicating with others as long as you have their contact information which can be stored in user profiles.

How would you ensure that your system is economically viable?

The main cost of this initiative would be building the platform itself. Once complete, we would only need a small administrative team to make updates and ensure the platform is running smoothly. Funding could come from donations, advertisements, and premium services (similar to other web apps).

How would the world be a better place if the system was actually implemented?

Access to clean water is a basic human need. This system would provide a lost-cost method for matching willing volunteers with opportunities to offer expertise, education, and services to areas in need, potentially saving thousands of lives.

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References

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