

Project Background

Land tenure security in Ghana continues to be an issue as various land practices and laws remain in contention with government land regulations. Challenges such as bringing land practices under one system, improper oversight of land, and land owners undeterred by prison terms in the event of a violation lead to slowed economic growth as current and potential landowners hesitate to engage in land transaction and money is instead tied up in length court decisions.

The objectives of this project are to stimulate economic development, reduce poverty, and promote social stability. To do this requires consolidation of the fractured urban and rural land administration systems.

Solution

The creation of a uniform system of registration and oversight will create transparency, continuity, and efficiency in the land administration leading to an increase in land security. The proposed system will provide homeowners and the administrators with accurate property line coordinates, up to date ownership records, and security against encroachment and illegal development. The nodes throughout the system will be able to monitor their locations as well as measure any significant vibrations that could occur if land was being developed on. The GPS coordinates can be used as an established perimeter of the land. These coordinates can be used by the land administration as well as the courts to clearly understand where property lines for given plots of land.

Immersion Focal Points

PIPS Electrical



Image 1: the team's full electrical set-up

PIPS Mechanical

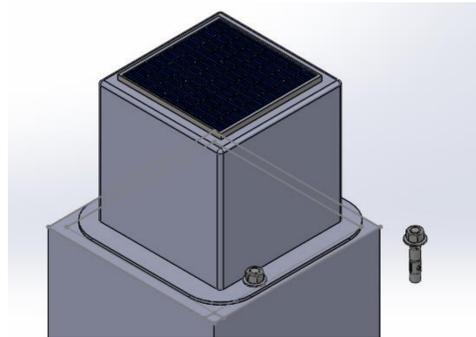


Image 2: an initial prototype design using wedge anchors

Intro to Engineering



Image 3: Ashesi students working on their final projects that Mark and Tom helped them with

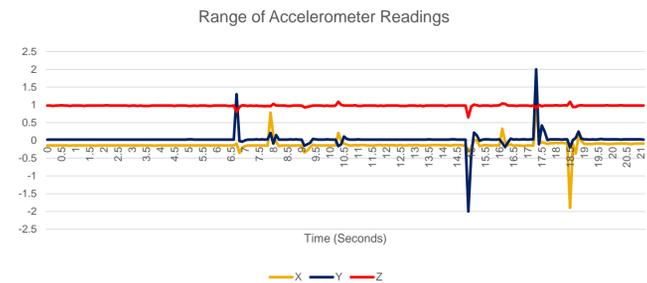
International Development Enterprises (iDE)



Image 4: Tom and Mark working with iDE on a recently developed prototype

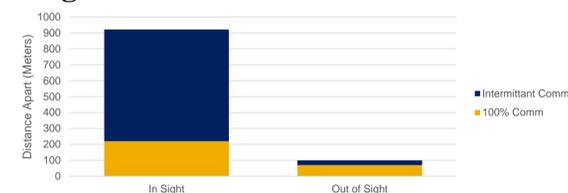
Results & Discussion

Accelerometer Test



Above is an example of some test results for the accelerometer test. In this damage test the accelerometer was fastened to a pillar, similar to those common throughout Ghana, and an Arduino Uno. The system was set up such that the accelerometer was not affected by connections to the Arduino. The test was performed by hitting the pillar with a rubber mallet to simulate impact on the pillar while trying to destroy the system.

RF Range Test



The test was set up using direct communication between two RF modules connected to two Arduino Unos. The results show that in open line of sight the RF modules work consistently up to 220 m and intermittently up to 920 m. Without an open line of sight, the RF modules only work consistently up to 70 m and intermittently up to 100 m. Since most plots will have wilderness or buildings between sensors, the communication system will need to be improved before implementation.

Recommendations

For future development of the prototype, the team recommends further testing, sensor improvement, phone application or other notification development, housing design, and cooperation with the current land administration. Further testing and improvements to the design would allow for increased reliability within the system. It would also be useful in determining how the system operates as a unit rather than proving functionality of each component. Additionally, components of the system can be improved to meet the needs of the application better. The development of an app or SMS system for notifications would be well received in a community that has great access to cell phones. These methods of alerts would ensure that land owners are able to receive updates in real time. Another recommendation is to develop housing for the nodes to improve protection of the sensors and the solar panel. Finally, in order to ensure the adoption of this technology, the team recommends getting in contact with officials in the Ministry of Lands and Natural Resources to determine the best way to implement PIPS to improve land tenure security.

Acknowledgements

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