

The Module Cell Phone

Wicked Prophets

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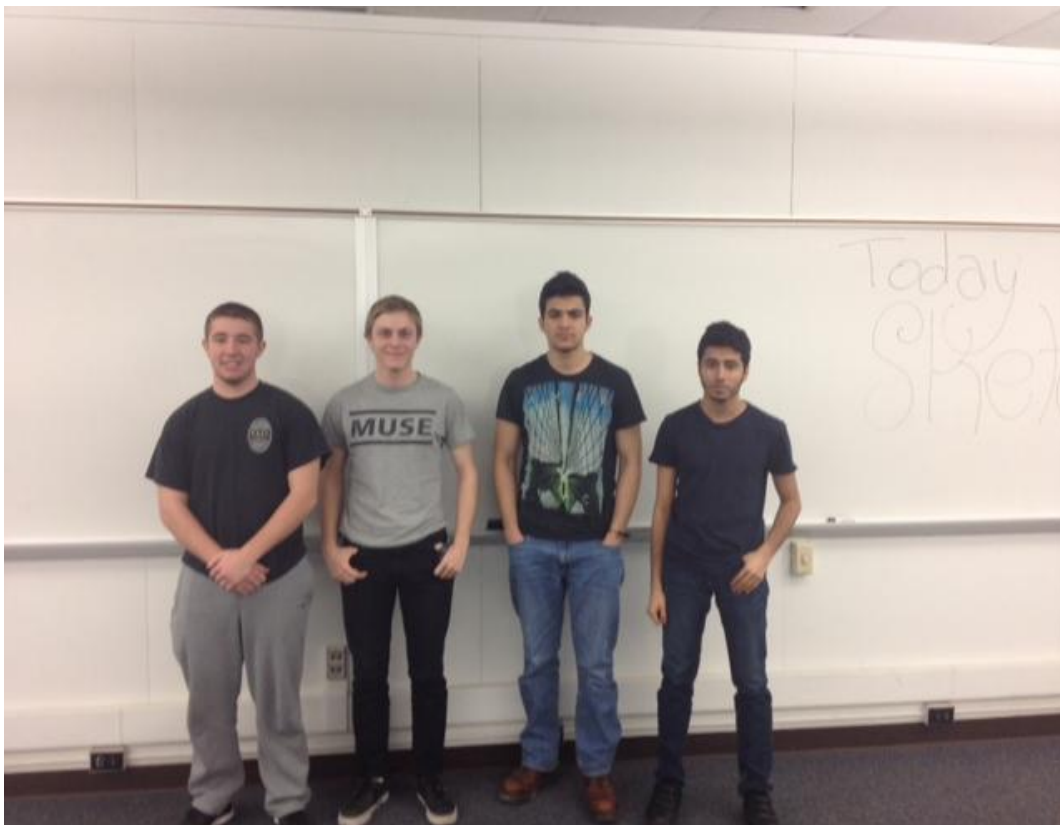


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Introduction: The Vision of the Project

Hundreds of years ago, the idea that one could access all of the information the world has ever known with a device that could fit in a pants pocket was unfathomable. With the invention of the internet, this idea began to become a reality as society made major strides in the advancement of communication technology. In recent years, the smartphone has reigned as the primary method for non-face-to-face communication due to its combination of being portable and easily accessible, and was the first true device to be able to carry out this “unfathomable” feature of unlimited access to information.

One negative consequence of the smartphone, however, is the amount of hazardous waste produced each year by the world’s booming population. This high volume of hazardous waste is contaminating the earth on an immense scale, and needs to be addressed in order to support a sustainable planet. Project Ara, a project headed by Google, addresses this problem by creating a modular system for smartphones in which only certain components of a smartphone need to be disposed of at a time, as opposed to disposing of an entire smartphone for one minor flaw.

The team “Wicked Prophets” quickly saw this project as a very promising new technology and the perfect way to not only improve communication, which was the task presented to us by AT&T, but also support a more sustainable future for technological devices.

Mission Statement

The Wicked Prophets, as a team of engineers at The Pennsylvania State University, utilized the design process to find a design that ensures a product or system that best fits the task presented to us, and also is environmentally friendly. We set out to improve communication and create a viable business structure for AT&T.

Abstract

After identifying an idea called Phonebloks as a very promising way to complete the task, we began to design our own version of this product, and add our own capabilities to the phone to improve communication.

During the designing process, we discovered that Phonebloks had developed into a project called Project Ara, spearheaded by Google, among other companies such as NK labs, LeafLaps, Rumble Development, Toshiba, New Deal Design, Motorola Mobility, and Metamorph Software. Upon this discovery, the Wicked Prophets redirected efforts from designing our own phone to designing our own module, or component for the phone developed by Project Ara. Our idea for a module, which would best complete the task presented to us of improving communication, is called the “integrated module,” which is designed to make better connections in the education and business communities by creating a secure network of information between members of these communities. We believe this idea is very promising for a company like AT&T because it allows for business partnerships with firms and universities, and the idea itself is very open to growth.

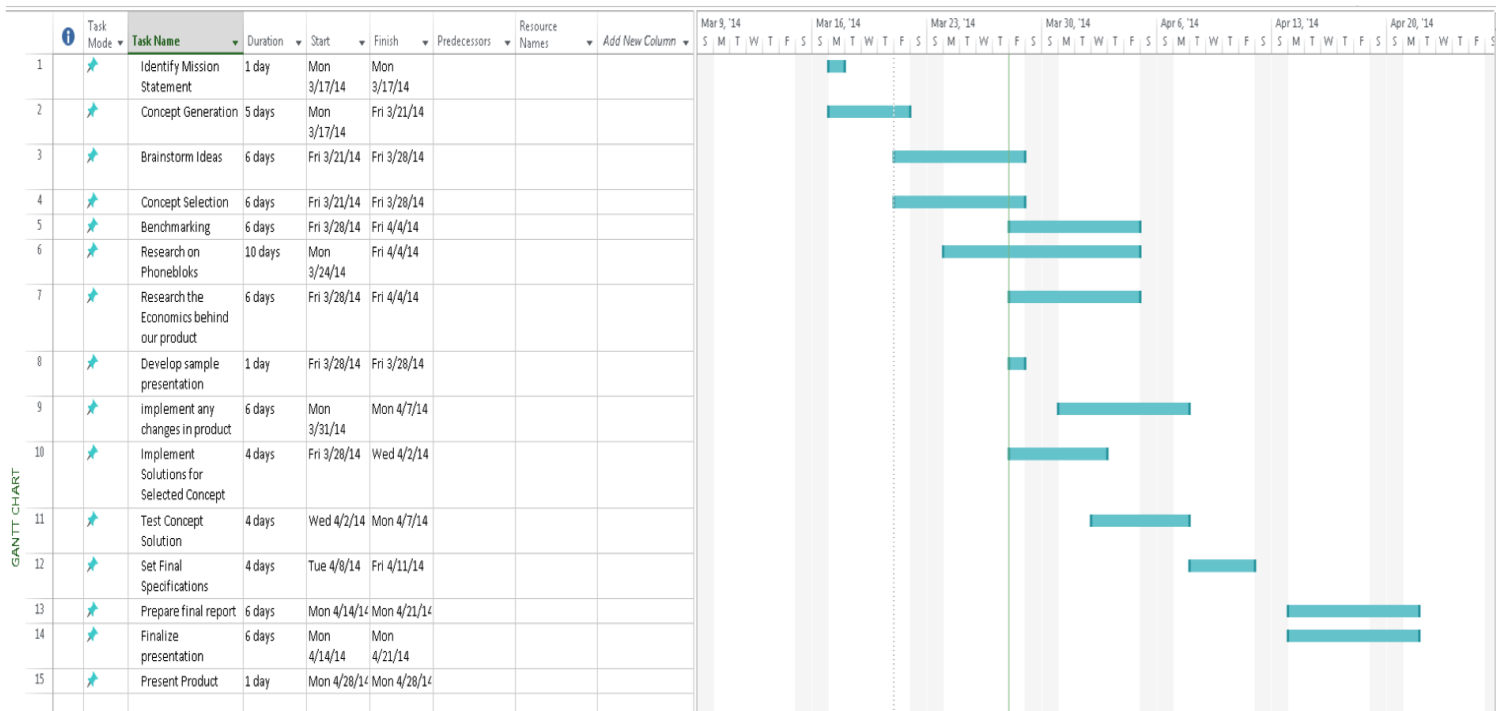
Customer Requirements

The group was presented with the task of improving communication by utilizing the “internet of things,” a concept coined and presented to us by the multinational telecommunications corporation known as AT&T. In their Statement of Work for the Client-Driven Design Project, AT&T states that the objective is to “identify opportunities that leverage real-time connectivity and new and emerging technologies to collect information that can be used for products and systems that benefit our lives.”

Needs Analysis

With the objective presented to the group, we interpreted the need as “develop a method to improve communication that is relevant to the motives of AT&T.”

Project Timeline



Concept Generation

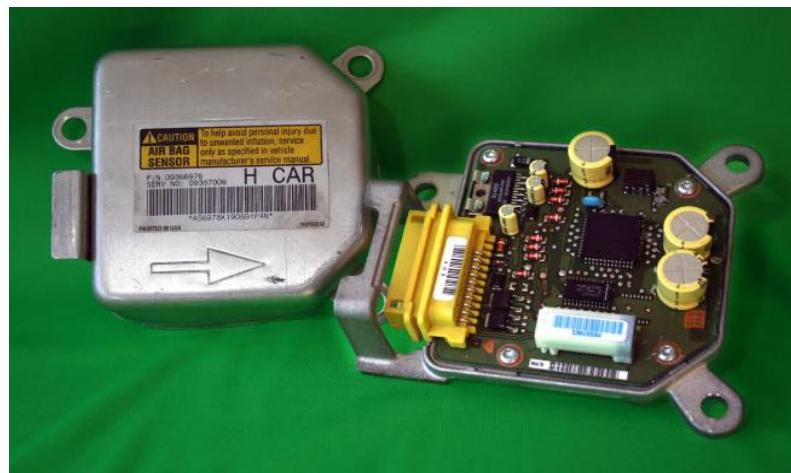
After reading and understanding the task presented, the group compiled a list of preliminary ideas that could complete the objective:

1. Applying Black box technology to cars
2. Smart watch with safety features (tracking devices, etc.)
3. Phonebloks
4. Crack sensors in baseball bats

Concept Research

Black box technology in cars:

The black box is an event data recorder that can collect and send data to guarantee passengers safety. In fact, car accidents are one of the most fatal accidents that we wish to prevent. In 2004 for instance, there were 6.2 million accidents reported by the police, 2.8 million people were injured, and 42,636 were killed. The idea for using black boxes was to reduce car accidents by monitoring car parts like brakes, gear box, and many other parts of the vehicle. The black box also tracks the car's speed to make sure that the driver doesn't exceed the speed limits. At first, we thought this was a good idea since it meets the project's statement especially since it's a new technology that can collect information to benefit our lives. However after researching we found that this idea already exists, so we eliminated this idea in the concept selection process.



Smart watches:

Smart watches have been experimented with since the late 1990's and have recently made appearances in the smartphone market. This technology basically combines all of the functions of a smartphone and presents them through the form of a touch-screen watch. The watches only work when the smartphone is within a certain radius, the two communicate via Bluetooth technology.

After briefly researching this emerging technology, the group realized that the smart watches currently on the market have every function you would need from a mobile device. Because of this, the team decided to research other technologies for our project.

Phonebloks:

What are they?

Phonebloks, initiated in 2013, is an idea that takes the modern smartphone and dissects it into removable components, called "bloks." This "Lego" like approach, which connects all of the "bloks" and a screen via a motherboard, allows the owner of the phone to have full control over how the phone looks and performs. Our group immediately identified Phonebloks as pioneering an "emerging technology," which is very relevant to AT&T's Statement of Work, and saw the potential to utilize this technology to complete the objective presented to us. This is the ultimate reason for choosing this concept to further develop. At the time the group was undergoing concept selection, Phonebloks was only an idea, and no specific designs or plans to launch a product had been published.



What is a Module Phone?

According to Ara Project release (Alpha 1.0) “Modules are the building blocks of an Ara phone. They are the hardware analogue to software apps. These are physical components that implement various phone functions. There are currently two major classes of modules: Front modules, which make up the front of the phone and generally provide user interaction or interface affordances such as the display, speaker, microphone, etc., and rear modules, which provide the bulk of the phone’s back-end [...] functionality. Front modules reach across the entire width of a particular endoskeleton frame, while rear modules come in three standard sizes (1x1, 1x2, and 2x2) and can fit into multiple frame sizes.”

Environmental Implications of Phonebloks:

In addition to being able to customize the phone, users can mitigate hazardous waste by replacing only the components that are expired or undesirable, as opposed to disposing the entire smartphone. According to the *Pew Research Internet Project*, 90% of adults in America own a

cell phone, and 56% of adults in America own a smartphone. The implications of these numbers suggest an astronomical amount of hazardous waste produced. In 2009, 129 million mobile devices were disposed, and only 8% of this amount was collected for recycling, according to the Environmental Protection Agency. Also, according to *Ethical Consumer*, a website that promotes sustainable consumption and ethical practices, a typical mobile phone produces the equivalent of 94 kg CO₂ emissions over its lifetime and 16kg CO₂ of this amount is due solely to the production of the phone. With these types of implications, there is a clear environmental issue regarding the use and disposal of smartphones. With modular phones, this issue can be significantly mitigated.

Baseball Bat crack sensors:

The idea:

While carrying out the brainstorming process, the group arrived at the possibility of inventing a sensor that would use AT&T communication technology to notify someone when a product or system is not functioning properly. Due to the group's collective interest in baseball, the idea of inventing a sensor that would detect an abnormality in a baseball bat emerged. The initial image of the product was a small, coin sized object that would cling to the bat but not impede its functionality. Once a crack in the bat begins to develop, the object would use sound waves, some sort of echolocation, to detect abnormalities in the bat and subsequently notify a bat boy or equipment personnel using the AT&T network.

Relevant research:

A very simple method for detecting a crack in a baseball bat exists that involves holding the bat by its center of mass and lightly tapping the handle on a firm surface, listening for any unusual vibrations in the bat. There is not, however, a product on the market that detects abnormalities in a bat in a quantitative fashion. The technology proposed while brainstorming, utilizing sound behaviors to detect abnormalities in structures, is often used on a much larger scale, such as the evaluation of sewage and water pipes, and is called “ultrasonic flaw detection.”

Concept Selection

	Concepts			
Selection Criteria	Smart watch	Modular Phones	Black box Technology in Cars	Crack Sensor in baseball bats
Relevant to AT&T	+	+	0	0
Profitable	+	+	+	+
Improves Communication	+	+	+	0
Emerging Technology	+	+	0	+
Environmentally Friendly	-	+	0	0
Sum +'s	4	5	2	2
Sum -'s	1	0	0	0
Sum 0's	0	0	3	3
Net Score	3	5	2	2
Rank	2	1	3	3
Continue?	No	Yes	No	No

Initial Target Specifications:

After following the preliminary steps in choosing a concept for our project, the group chose to approach the modular phone as a product to pitch to AT&T. The group then began to produce ideas for the design and financial structure for the phone:

Design of the phone:

Design certain Phonebloks models i.e. student, businessman, construction etc.

Different Bloks:

- Connection to video game consoles
- Cloud storage
- **Specific University software or specific business software**
- Physical keyboard Blok
- Different Phonebloks sizes
- Fingerprint scanner

Preliminary prices for the phone and components:

- Standard Edition \$110.00
- Bloks cost \$5.00-\$99.99
- Student Package \$49.99
- Other custom package prices TBD
- Contract (2yrs.) \$10.00-\$50.00 per month

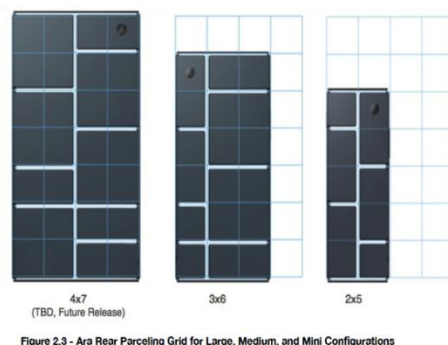
Benchmarking- Project Ara:

On April 9th 2014, Project Ara, the project headed by Google and Motorola that began making Phonebloks a reality (just as we were designing to), released an Alpha version called the Module Developer's Kit (MDK) that contained full specifications for a functional modular cell phone. Here is a very brief collection of the content in the MDK:

Module Phone specifications:

1. Dimensions:

There are three possible sizes: large, medium, and mini:



Developer's Conference

On April 15th and 16th 2014, Project Ara also held a Developer's Conference, in which they released prototypes of the phone:



Rethinking the project: The Integrated Module

The release of the MDK and the Developers Conference by Project Ara forced the Wicked Prophets to reconsider our project. There was no sense in designing an entire phone if the design had already been published before. So, we decided to instead focus our efforts on designing a specific module for the phone. In our initial design for a phone, we came up with an idea to create a module that contains university or business-specific software, and we decided to expand on this idea, calling it the “Integrated Module.”

This module would “integrate” all forms of communication within a business or university and create a secure network so that students and businessmen may communicate more efficiently with each other. For students, this network gives the ability to check and send emails with the university utility, check grades, schedule classes, and view their bills. It would also provide the ability to schedule appointments with professors and communicate with students in the same class. Essentially, by initially inputting a student access code and password, the phone would know everything there is to know about the student’s academic career and provide the student with the means to efficiently communicate with other students and faculty.

For businesses, this module would create a secure network through which employees can safely communicate. Also, since many companies require the employees to have an additional “work” phone, this module would come with SIM card capabilities, which would allow employees to have a modular phone that is both a work and a personal phone.

Final Product Design Components

University Module (PSU edition):

- PSU WebAccess utilities
 - ANGEL Course Management System
 - PSU Webmail
 - eLion
 - eLiving
- Tracking Feature
- NFC
 - Building access
 - LionCash

Business Module:

- Intrinsic communication network
- SIM card capabilities
- NFC
 - Building/room access
 - Company purchases

Explanation of Various Components

Tracking feature idea:

We came up with a hardware feature which is basically about a tracking chip that can be placed into the block to track the flow of students over the campus area. In this way we can provide the students with information about the number of students in each building especially places like the library and the HUB. So if the library has a higher number of students than usual, students will be notified so they can go to other buildings that are not as crowded. Students can also track and find their phone if they lose it easily. This tracking feature can be used to benefit other business companies that have different purposes.

Near Field Communication

Our other idea is to use magnetic technology to serve as id or credit cards which can be used to enter the different facilities at the university like the gym or the residence halls. There are some inventions here and there that use a similar technology. We can use the block also to make purchases through the student's bank account. For example, in Massachusetts, there is an app called Mobile-lime which is one of the first mobile payment systems in the United States. This system allows you to buy goods and services using your cellphone instead of your credit card. However, this system does not work for all businesses. It's a limited service that can be expanded and brought to the Modular phones.

Another emerging technology is called NFC or (Near Field Communication). NFC “is a set of standards for smartphones and similar devices to establish radio communication with each other by touching them together or bringing them into proximity, usually no more than a few inches”. MasterCard use this technology; they call it MasterCard PayPass. The definition of MasterCard’s PayPass as mentioned in their website is “a contactless payment feature that provides cardholders with a simpler way to pay. Now, you can simply tap your card, key fob or cell phone, on a point-of-sale terminal reader to pay. It works just like your traditional MasterCard payment card-but no more swiping or giving your card to cashiers”. So it works like the credit card does, however, its more secure and efficient since you don’t have to give your card to the salesman to swipe it.... Big names in technology and communication industry like Apple Android are working on bringing this technology to their next version of smartphone.



AT&T and NFC:

AT&T is already bringing NFC to its customers through “The Isis Mobile Wallet” which is a system allows you to pay using your smartphone. Customers who sign up for this service can get their smartphones equipped with a near field communication technology which includes

hardware and software implements. In Android case, all it needs is to take the smartphone to AT&T to provide it with the necessary hardware to make the feature available on your phone. In fact, the hardware is essentially a chip element that can be placed inside the smartphone to guarantee your account security. For iPhone users, it will need to buy a special phone case that is provided with an ISIS antenna to make the phone able to make payments. It also needs an enhanced SIM card to make sure that the payments are secured in both cases.

Business Structure

Our design is essentially a service for business and universities that utilizes already existing hardware, the modules designed by Project Ara, to create a module that provides the functions listed for the clients, in addition to other intrinsic functions that the client may request.



Price of the Module

Since this technology is incredibly new, there is a very small amount of information on the pricing of modules. According to a CNN new article, the initial price of the Project Ara phone will be around \$50. From this value, we can only estimate a price of the module we are offering. Since we are providing a large service of preloading a lot of information onto a device, we can estimate the initial price of the Integrated Module to be no more than \$50.

Profitability for AT&T

According to creative destruction theory, society incessantly destroys old systems and creates new systems of a higher quality. We believe that the modular system for technology is a new, higher quality system for smartphones than the current system, and that its introduction into society will lead to the eventual destruction of the old system. In short, modular phones are the new wave of technology to reach the market, much like how smartphones reached the market and replaced “dumb” phones.

Modular phones are cheaper for the customer to own because they don’t need to be continuously replaced. They allow for full customization of the phone, aesthetically and functionally. We believe that integrated modules contribute to this customizability, while also enhancing communication, which makes it a very attractive product to the customer.



Conclusion

After deciding to pursue module cell phones as our group's project, we researched the many components that are involved in a module phone. The researched proved some valuable information that would help us pitch our product to AT&T. The outstanding features of our product that would be most appealing to AT&T are: module cell phones are environmentally friendly, customizable, and they introduce possible business/investment opportunities for AT&T. The product that we are designing for AT&T has unlimited possibilities for future improvements. Technology is ever-changing and we believe that we have created a product that would dramatically increase not only AT&T's revenue but also increase excitement for other AT&T products. For the Wicked Prophets, a valuable lesson from this project is that the design process does not always pan out as planned, because external factors, such as Project Ara, may pose as major setbacks to the design.

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