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Wireless Piconet Item Loss Prevention System with Sensor Capabilities on Android Platform

A thesis submitted in fulfillment of the requirements for the degree of:

Bachelors of Science, Electrical Engineering

By

Justin Phillip Yang

Yantao Shen, Ph.D., Thesis Advisor

May, 2012
Proposed that the thesis prepared for the Honors Program under supervision by:

Justin Phillip Yang

Entitled:

**Wireless Piconet Item Loss Prevention System with Sensor Capabilities on Android Platform**

Be accepted in fulfillment of the requirements for the degree of:
Bachelors of Science, Electrical Engineering

______________________________________________
Yantao Shen, Ph.D., Thesis Advisor

______________________________________________
Tamara Valentine, Ph.D., Director, **Honors Program**

May, 2012
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I. Executive Summary

The concept for a smartphone notification system known as Tag n’ Grab was manifested from a desire to solve a universal problem: forgetting, misplacing, and losing life-essential belongings. For example: people forget and lose phones, keys, and laptops at airport security checkpoints or in hotels. People may even lose their phones. The Tag n’ Grab notification system is the agile solution.

Tag n’ Grab began as a collaborative effort by an innovative group of university students. As a result, GrabiTech Communication (GTC) was formed which will be structured as a limited liability company headquartered in Reno, Nevada. GTC’s primary goal is to be the premier provider for designing, developing, and distributing agile alert solutions for household consumers and working professionals.

Tag n’ Grab provides alerts through a smartphone software application that is paired to a battery powered wireless transceiver. The application detects when communication between the tagged device and phone become weak, and it notifies the user to grab the tagged device. Additionally, if the user has a transceiver and has misplaced their phone, the transceiver can be used to ping the phone. Although there are other devices to solve this problem, Tag n’ Grab demonstrates superior innovation with compatibility on multiple mobile operating systems, an easier-to-use application with sensor add-on features, and greater affordability. This results in what GTC envisions to be a competitive edge in the market.

GTC’s intent is to create a startup LLC with focus on direct marketing in a variety of venues. With a substantial advertising budget, GTC is confident in building product recognition which will then lend itself to creating retail partnerships with retail entities.

GTC is comprised of five students from the University of Nevada, Reno. Each member has a different set of diverse, but complimentary, personalities and talents. This team retains excellent group chemistry.

The initial investment sought by GTC is $700,000 in Stock Sales and $500,000 by loan. This amount will cover operating costs until the company is profitable on a monthly basis. The anticipated timeframe for GTC achieving the goal of being profitable is in the 6 month of year 3. The growth of Tag n’ Grab’s market is expected to rise rapidly thereafter, and a return is expected in year 4.

GTC intends to continue operation into the foreseeable future, while continually expanding and revising its product line. Tag n’ Grab is a concept that can easily be adapted to fill other uses in the marketplace, and GTC will investigate opportunities in those areas.
II. Company Overview

GTC will design and distribute the Tag n’ Grab notification system: software and hardware designed to aid consumers in keeping track of their belongings. The research and development of the Tag n’ Grab system has been the result of envisioning a combination of convenience and technology, which also has potential for future product diversity. Software features and ease of use are important qualities that users consider when downloading applications for their smartphones. The two application based notification systems currently on the market are costly, retain limited battery life, have minimal applications features, and are restricted to single operating systems. By addressing these hindrances, Tag n’ Grab offers a competitive edge in the smartphone personal notification market.

**Vision:** GTC envisions becoming the world leader in agile personal notification systems to manufacturers and consumers by fulfilling a customer need that has long been over-looked by existing industries. GTC’s commitment to all customers and successful execution on such commitment will ensure GTC’s growth and profitability

**History:** GTC was formed in January of 2012 by a group of engineering students at the University of Nevada, Reno for a senior design class. The training and commitment to excellence instilled in each partner propelled the launch of GTC from concept to company with a marketable product line. Though the company is still in the early stages of development and refining the product, the profitability goals are attainable and the founders are prepared to turn vision into reality.

**Current Status:** GTC is in stages of product market development and product prototype development. The business plan and marketing strategies are being finalized so that funding can be acquired to bring the Tag n’ Grab product line to market.

**Strategy:** GTC’s strategy is straightforward: there is a vast market in smartphone personal notification systems in which GTC eventually intends take leadership. Tag n’ Grab is designed to a well-defined market. Initially, customers will be reached through online advertising, technology magazines, and trade shows. Eventually, after the brand and product are established in the market, partnerships will be sought out with companies specializing in electronics retail.

### Mission Statement and Goals

GTC strives to be the primary provider of smartphone notification systems for retailers and consumers in five years. The goal is to ensure that the customer enjoys the convenience and versatility of an alert system on a smartphone. The mission of GTC is to address and satisfy demand for an agile alert solution for consumers. To obtain this, GTC has established the following goals:

- Obtain sales revenue of $2.5 million dollars equating to 103,000 units sold
- Meet market demand and maintain excellent quality products
- Keep manufacturing and distribution costs below 75% of revenue

The keys to GTC’s success in meeting the goals:

- Maintaining intimate business relationships with manufacturers and retail outlets
- Adapting to changing business environments for different regions and customer demands
- Developing future product lines for return customers
III. Product Details

Product Description

Tag n’ Grab is a two-way loss prevention, monitoring, and organization system. It will allow users to utilize their smartphones to keep track of items using an end device, and the end the device can be used in a fashion to ping the smartphone. The user will download a free smartphone application to communicate with the end devices, for a retail price of $50. The Tag n’ Grab will provide consumers an inexpensive and powerful widget to keep track of their belongings. As Figure 1 illustrates, the application will be sleek, simple, and intuitive. In addition, the application will contain more detailed settings for further customizations should the user desire.

In year 2, interchangeable sensors will be available as an add-on to the preexisting Tag n’ Grab for a plethora of applications. Users will be able to use different types of sensors to monitor temperature, humidity, light intensity, natural gas levels, and even alcohol levels. For example, the humidity sensor can be used by cigar enthusiasts for maintaining sufficient moisture levels in cigar boxes. Temperature sensors can be used to monitor room temperature or temperature sensitive items. Natural gas levels can be monitored for household safety, and users can even insert an alcohol sensor to determine if they are under the legal alcohol driving limit. The user will be able to purchase sensors separately and connect them to the end device in any fashion. This customization empowers users to be prepared for any type of situation. Figure 1 shows software screenshots and figure 2 shows action screenshots.

![Figure 1: Preliminary Smartphone Application Design](image-url)
The user will tag the desired items he or she chooses using the Bluetooth end device as shown in Figure 3. Once the user tags an item and configures the settings for the item, the user will be sent a notification if the tagged item is out of range for 20 seconds. The phone and end device will maintain communication once the tagging has been set. At this point, battery level and signal strength characteristics can be pulled up on the smartphone. Figure 2 shows an alert to notify the user that the tagged wallet is out of range. Depending on the level of importance of the item, the user will be able to specify how far the tagged item can go and how long the item can stay out of range.

### Current Stage of Development

The Tag n’ Grab is currently in the design reviews in concept stage as seen in figure 4, GTC has completed the preliminary design for the product. The quality assurance will begin during the last 2 of months of R&D, and the prototype will be tested rigorously. As the testing and analysis of the product commence, design and features will be adjusted accordingly.
Figure 4: Product Development Cycle

- **Product Planning Review**: Market trend research, comparisons with competing products.
- **Design Reviews in Concept**: Feasibility studies for product development, examine product liability, safety standards, patent and IP assessment.
- **Experimental Stage**: Determine prototype conformity to quality standards, safety examination.
- **Quality Approval**: Examination and approval of products by QA department.
- **Production**: Product approval, initial production, product checks on mass-produced products.
- **Markets**: Customer survey, customer feedback.
**Innovative Position**

*Tag n’ Grab* will promote a unique way of ensuring consumers in remembering and locating their personal belongings. GTC intends to continue its process of searching for similar products and continuing competitive research to ensure fulfilling a unique and unmet market segment for future customers. An intellectual property description disclosure will be completed to guarantee that any subsequent applications for the current and next generation products are protected. When appropriate, patent application(s) will be filed on the current designs, future designs and associated technologies. The application(s) will be professionally drawn with the assistance of a patent attorney.

It is ill-advised to assume all design criteria for the *Tag n’ Grab* notification system will require patent protection. As such, periodic and objective reviews of all design changes are necessary and expected to ensure the best possible protection, design, and development for the product line.

**Product Competition**

The general concept for *Tag n’ Grab* is fresh but has been previously attempted. Table 1 on the next page details competing products. As shown, Cobra Tag and Bikn do not accomplish the same goals as *Tag n’ Grab*. The Cobra Tag (priced at $60 for each end device) focuses primarily on item and phone loss prevention by proximity calculations, and while it does that job, its application and hardware do not assist in item organization. The Bikn, on the other hand, is an iPhone only product and at the price of $120 to start, is a luxury item to consumers. The *Tag n’ Grab* will provide additional features and higher performance than competing systems by having longer battery life, a user friendly application interface, and sensor add-on features.

**Sensory Applications**

**Temperature Sensor:** Sensors can also be placed outdoors to easily send you information on the weather and any other situation in which the consumer may need to find the ambient temperature such as in their wine cellar for those precious bottles that need a little extra care.

**Humidity Sensor:** This can also be used to make sure that precious mementos such as pictures do not get damaged because of high levels of humidity. These sensors can also be placed into cigar boxes where humidity levels must be kept at an optimum level.

**Light Sensor:** The light sensor can detect the presence or absence of light or a change in the status of the light in the room. This sensor can be used to remind the user to turn off a light in order to save energy in household applications.

**Alcohol Sensor:** The alcohol sensor can be utilized as a self-awareness aid, attached to *Tag n’ Grab* to indicate the blood alcohol levels in the user’s breath. In a more fun application, this sensor can also active trigger locks on your smart phone creating a do not call list that the user inputs ahead of time so as to avoid any embarrassing phone calls.

**Natural Gas Sensor:** Natural gas levels can be monitored and alerts can be sent through smartphone applications if the stove is accidently left on.
Table 1: Competitive Comparison

<table>
<thead>
<tr>
<th>Product</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cobra Tag</td>
<td>Smaller size</td>
<td>Only works on Android operating systems</td>
</tr>
<tr>
<td></td>
<td>GPS Tracking</td>
<td>Shortest battery life</td>
</tr>
<tr>
<td></td>
<td>Links to Facebook/email</td>
<td>More expensive - $60</td>
</tr>
<tr>
<td>BiKN Tag</td>
<td>Smallest size</td>
<td>Only works on Apple operating systems</td>
</tr>
<tr>
<td></td>
<td>Longer battery life</td>
<td>Most expensive - $120</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Requires additional hardware on the phone</td>
</tr>
<tr>
<td>TAG N' GRAB</td>
<td>Multiple operating system functionality</td>
<td>Slightly larger design</td>
</tr>
<tr>
<td></td>
<td>Longest battery life</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sensor add-on capability</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Least expensive - $50</td>
<td></td>
</tr>
</tbody>
</table>
IV. Marketing and Competitive Analysis

The demand for a smartphone notification system will follow the expanding smartphone market. Nielsen Company has predicted that by Q3 2012, the amount of smartphone users will surpass feature phone users as shown in figure 5. In the United States, more and more people are “ditching” feature phones for smartphones. This information reinforces the breadth of the U.S. market in which GTC hopes to supply. On July 11, 2011 an American smartphone study performed by the Pew Research Center revealed that 35% of American adults own a smartphone, equating to 108,060,938 smartphone users. The following sections describe GTC’s customer focus within this group.

Age

The Tag n’ Grab notification system targets busy household consumers and the working class. The pace of contemporary society is becoming faster thus increasing the difficulty in keeping track of personal belonging. Suburban and urban consumers would use Tag n’ Grab on a regular basis for keeping track of important items such as wallets, medication, and keys. Working professionals would use Tag n’ Grab for remembering to bring important paperwork and documents to business meetings. As a result, GTC has targeted smartphone users aged 18-54. Americans in this age spectrum encompass people who have
a heavy dependence on smartphones and smartphone features and applications. These may include college students and blue and white collared workers. Figure 6 shows the distribution of GTC’s target customers with respect to age. Smartphone ownership is the highest among Americans in their 20’s and 30’s as around 58% of Americans aged 25-34 own a smart phone.

Figure 6: Smartphone Ownership Distribution

According to preliminary informal marketing surveys, the target customer would be willing to pay an average of $50 for the Tag n’ Grab. Based on this information, GTC has targeted a customer basis with a minimum average household income of $30,000. Figure 7 illustrates that the mean household income satisfies GTC’s customer profile. Deciding a reasonable price is an essential part of GTC’s financial success. Providing a more affordable product than GTC’s competitors (Cobra-$60, and Bikn-$120) will serve as an advantage to GTC’s success in the market.

Household Income

Demographics and Geographic Location

GTC intends to reach customers living in urban and suburban neighborhoods. Many wage earners living in this geographic location tend to work the traditional 8-5 schedule and have busier schedules than rural area inhabitants. Figure 8 illustrates in more detail the demographics of smartphone ownership.

Market Opportunity and Acceptance

Based on the information presented in figures 5-8, GTC has determined a strong customer profile for Tag n’ Grab. GTC has specified an opportunistic age group for market acceptance, and the amount of smart phone users will steadily increase until smartphones become the standard for mobile communication. By year 5, GTC hopes to reach 0.06% of the market population of 65,057,176 equating to 376,000 units.

Figure 7: Mean Household Income Satisfied

Figure 8: Smartphone Demographics
The Notification System Demand

Ponemon Institute conducted a June 30, 2008 survey on the number of lost laptops per week in U.S airports. Based on their data, it was determined that business travelers lose more than 12,000 laptops per week in U.S. airports. Only about 33% of these laptops within lost and found departments are reclaimed. This is because 70% of business travelers feel rushed when trying to get on their flights, and 60% worry that delays due to security checkpoints will cause them to miss their flight. Figure 9 shows numerical figures on the frequency in which flyers in Class B (Bravo class: largest airport airspace) and Class C airports lose their laptops.

### Summary of lost, missing, or stolen laptops at U.S. Airports

<table>
<thead>
<tr>
<th>Class</th>
<th>Frequency Per Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class B airport average</td>
<td>286</td>
</tr>
<tr>
<td>Class B lost laptops per week for 36 airports</td>
<td>10,278</td>
</tr>
<tr>
<td>Class C airports average</td>
<td>28</td>
</tr>
<tr>
<td>Class C lost laptops per week for 70 airports</td>
<td>1,977</td>
</tr>
<tr>
<td>Total lost laptops per week</td>
<td>12,569</td>
</tr>
</tbody>
</table>

**Figure 9: Laptops Lost Per Airport Type**

As devastating as it is to lose a laptop, often the content on the laptop is much more valuable than the laptop itself. Information such as customer bank account information, intellectual property, and business information can be lost or worse, compromised and taken advantage of by the wrong hands. The following figure shows information that Tag n’ Grab can help consumers keep track of, by tagging their laptops.

![Information Lost on Laptops](image)

**Figure 10: Information Lost on Laptops**

In additional to lost laptops, studies have shown that on an annual basis, travelers leave millions of personally important items such as wallets, keys, cellphones, and eyeglasses in hotels, airports, airplanes, and rental cars. Airline company Southwest stores lost items in a 4,000 square foot area where many unclaimed items stay there for 30 days before they are donated to the Salvation Army. McCarran airport in Las Vegas retains statistical data in which 30,000 items—an average of 82 items a day, are left behind each year. Additionally, Novotel surveyed 31 hotels and found that shoes and clothing were forgotten most often, followed by keys, laptops and jewelry.
GTC has performed strategic planning in order to ensure the success of the *Tag n’ Grab* product line and subsequent products. Figure 11 is a SWOT analysis of GTC’s business. GTC’s weaknesses have been characterized by a lack of manufacturing equipment, a small staff, a large startup cost and a late market entry. A lack of manufacturing equipment will be addressed with GTC’s strategy in outsourcing all manufacturing and assembly tasks overseas to China. This will ensure low product costs and bypass startup costs incurred from purchasing expensive manufacturing equipment. Over time, GTC will address staffing shortages by hiring human resource and customer support specialists in aiding GTC employees and customers with day to day tasks. Although GTC has a late market entry, this issue will be addressed by providing customers with a far superior product. Adding an interchangeable sensor feature with the *Tag n’ Grab* will ensure an immense competitive edge over similar products from Cobra and Bikn by providing a means of attracting return customers and expansion on the preexisting *Tag n’ Grab*.

As illustrated in figure 6 in the Market Analysis, the majority of smartphone users are aged 18-44. These numbers will increase as smartphones become cheaper, and it is also highly probable that the number of smartphone users aged 55 and up will also increase as the current generation of smartphone users will shift forward and become the new elderly generation. It is highly unlikely that as current users age, they will stop using smartphones because users today have become extremely dependent on their devices. GTC has recognized this trend and will capitalize on the expanding smartphone market by taking advantage of the continuing smartphone expansion. Finally, the interviewees from the 2011 Pew Survey have explained their cell phones as:

![Figure 12: Smartphone User Description](Source pewinternet.org)
The following table lists GTC’s competitive strategies in operations:

**Table 2: Competitive Strategies**

<table>
<thead>
<tr>
<th>Adaptable</th>
<th>Core Competence</th>
<th>Return Customers</th>
</tr>
</thead>
</table>
| - Flexibility with sensors add-ons | - Uneasily intimidated by competitors:  
  ▪ Superior technology, Innovative aptitude  
  ▪ Sensors provide re-usability for many products/markets  
  ▪ Positive contribution to customers  
  ▪ Brings customers a sense of security, confidence | - Purchase of additional wireless transceivers  
  - Additional sensor packs:  
    ▪ Humidity  
    ▪ Temperature  
    ▪ Alcohol  
    ▪ Natural Gas  
  - Application upgrades  
  - Greater Bluetooth communication distance |
| - Multiple applications besides tagging (monitoring) | | |
| - Tablet computer adaptability to meet the progress of mobile computing and monitoring applications | | |

<table>
<thead>
<tr>
<th>Globalization</th>
<th>Impact</th>
</tr>
</thead>
</table>
| - Eventual entry into Chinese markets | - Premier provider in smartphone personal notification devices  
  - Alter lifestyles by keeping track of all personal belongings |
| - 24 million smartphones shipped to providers in China during the 3rd quarter of 2011 | |

Currently, GTC is designing *Tag n’ Grab’s* competitive edge with sensor swapping capability. Although this is a key factor in beating out competitors such as Cobra and Bikm, sensor swapping has an enormous role with GTC’s long term goals. After GTC has established a consumer base with *Tag n’ Grab*, it is GTC’s vision that consumers will also use tablet computers with the aid of upgraded software to not only keep track of their personal belongings, but to monitor more important things, such as natural gas levels, indoor air quality, and to even aid in minimizing drunk driving with the use of an alcohol sensor. Bluetooth communication is currently GTC’s main focus in wireless standards, but GTC has future goals in establishing enough equipment for users to communicate with their devices from work or anywhere where there is wireless access. It is GTC’s goal to empower smartphone users with an affordable array of sensory options to make everyday life more convenient.
# V. Management Team

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Justin Yang</strong></td>
<td><strong>Chief Executive Officer</strong></td>
<td>Oversees All Operations, Customer Relations, Establishes Vendors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Justin has previous leadership experience as the President of the Institute of Electrical and Electronics Engineers (IEEE, Nevada) student chapter. He also has extensive internship work experience in systems, communications, and electronics engineering.</td>
</tr>
<tr>
<td><strong>Felicia Groso</strong></td>
<td><strong>Chief Operating Officer</strong></td>
<td>Design Development, Customer Service Management, Operations Management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Felicia has worked designing firmware, and has acquired knowledge in C, C#, and Java programming languages. Her specializations are in fields and communication, in which the majority of her technical electives have been taken.</td>
</tr>
<tr>
<td><strong>Cho Yu Chong</strong></td>
<td><strong>Chief Technology Officer</strong></td>
<td>Product Development, Website/App Management, Quality Management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cho has over five years of technical experience as an information technology student worker, tutor, and research assistant in a biomedical instrumentation laboratory. His background experience in programming in C++, java, and assembly will contribute to the software development for GTC.</td>
</tr>
<tr>
<td><strong>Victor Morrow</strong></td>
<td><strong>Chief Marketing Officer</strong></td>
<td>National Sales Management, Marketing Coordinator, Product Development, Customer Relations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Victor a strong communication background and five years of sales experience in a variety of industries as well as having a sales and technical background in the telecommunications industry. He has strong leadership qualities and has been a key asset in several companies as both a trainer and innovator.</td>
</tr>
<tr>
<td><strong>James Malone</strong></td>
<td><strong>Chief Financial Officer</strong></td>
<td>Accounting, Collections, Statistical Analysis, Customer Relations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>He has extensive experience in retail and production and is familiar with job costing, bookkeeping, and managerial accounting. With his experience with managerial accounting he will be able to provide analytical information regarding production, efficiencies, and other opportunities for improvement.</td>
</tr>
</tbody>
</table>
President
Justin Yang
jyang89@gmail.com

Chief Operating Officer
Felicia Groso
fgroso6@gmail.com

Chief Finance Officer
James Malone
Jmalone7@gmail.com

Chief Technology Officer
Cho Yu Chong
choyu89434@gmail.com

Chief Marketing Officer
Victor Morrow
dbsaijen@yahoo.com
VI. Operating Strategies

Corporate Entity and Business Structure

GTC intends to start their business as a limited liability company in northern Nevada and plans to branch into other strategic areas as the business grows. The goal is to establish a customer base by working with technology trade shows and using direct advertising in target markets. GTC will be outsourcing to begin drafting contractual agreements with various product distributors, a law firm for legal advice, and other appropriate professionals (i.e. a marketing firm) within the Nevada area, as needed. GTC will outsource manufacturing the Tag n’ Grab notification system to China. Reputable Chinese distributors will supply all of the necessary components, and all hardware components of the Tag n’ Grab system will be manufactured by KeyTronicEMS. The finished product will be delivered to GTC where packaging of the product will take place. Once the sales and margins increase to require alternative manufacturing methods, other production methods will be conveyed to KeyTronicEMS.

Advisory Board

Dr. Candice Bauer
Dr. Bauer is a Lecturer and Director of Assessment and Student Affairs for the University of Nevada, Reno. She was Vice President of the American Society of Mechanical Engineers (2007-2009) and has over ten years of experience as an accountant. She has served as professional advisor to GTC.

Dr. William Avery, PE
Dr. Avery is the team’s primary technical advisor. He was chosen by the team for his non-academic background as an entrepreneur and a successful small business owner. He is currently a member of the faculty at UNR.

The core advisory board consists of the following members: Justin Yang, Victor Morrow, Felicia Groso, Cho Yu Chong, and James Malone. As a team, they will shape GTC and Tag ‘n Grab. However, the core advisory board will consult external professionals in business planning, legal advice, and other necessary areas. By seeking professional help as the need arises, the management team will be able to create a strong foundation from which GTC can expand.

Production

GTC will outsource all manufacturing and purchased components with China. The circuit board component placement, soldering, and final assembly will all be performed by KeyTronicEMS. It has been projected that during the first year 150 base units will be sold. A contract will be developed with KeyTronicEMS to ensure confidentiality and high quality. GTC’s product design and business plan will not change if an international approach is pursued. Figure 13 on the following page illustrates GTC’s production process from design to distribution.
Figure 13: Design, Development, Distribution Flow Chart

**GTC Design and Engineering**
- Printed circuit board blueprints created from GTC engineering office
- Sample design schematic

**Delivery from GTC to KeyTronicEMS**
- Delivery of blueprints, sample schematic, and bill of materials from GTC to KeyTronicEMS

**KeyTronicEMS Development and Manufacturing**
- Printed circuit board manufacturing
- External casing manufacturing

**KeyTronicEMS Testing and Quality Control**
- Electrical functionality testing
- Durability test
- Power testing

**Delivery from KeyTronicEMS to GTC**
- Fully assembled and tested product, ready to use

**GTC Testing and Quality Control**
- Performance testing
- Electrical, durability, and power testing

**Distribution**
- Assembled Tag n’ Grab notification system ready for distribution

Tasks performed by GTC in the United States

Tasks performed by KeyTronicEMS in China
**Phase 1**

*Length*
5 Months

*Accomplishments*
- Business License Obtained
- FTC Approval
- Vendor Established
- Website/Apps Complete
- R & D Complete
- Tag N' Grab Inventory

**Phase 2**

*Length*
7 Months

*Accomplishments*
- Advertising Establish
- Local Market Entry
- R & D Sensors
- Social Media Expansion
- Role Establishment
- Large: Building Move
- FCC Sensor Approval

**Phase 3**

*Length*
7 Months

*Accomplishments*
- Sensor Entry
- California Market Entry
- Increase Advertising
- Expand operations

**Sale Goals**
- Retail $133,050
- Whole Sale $57,800

*Job Creation*
- Sales/Marketing 2
- Website Team 1
- Shipping 1

**Phase 4**

*Length*
5 Months

*Accomplishments*
- Market Advertising
- Market Penetration
- Online Market Penetration
- Research & Development
- Increase Sales Team

**Sale Goals**
- Retail $16,750
- Whole Sale $9,270

*Job Creation*
- Customer Service 1

**Phase 5**

*Length*
1 Year

*Accomplishments*
- Full Staff Obtained
- Inventory Capacity Upgrade
- Advertising Budget Increase
- California Expansion
- Break-Even

**Sale Goals**
- Retail $1,531,050
- Whole Sale $413,850

*Job Creation*
- Customer Service 1
- Engineering 1
- Sales/Marketing 1
- Shipping 1
- Accounting 1
- Web/App Team 1

**Phase 6**

*Length*
1 Year

*Accomplishments*
- Advertising Budget Increase
- Positive Retained Earnings
- Multiple City Penetration
- Developed Market Target Strategy
- Cash Balance Increase

**Sale Goals**
- Retail $3,462,500
- Whole Sale $2,221,800

*Job Creation*
- Customer Service 1
- Accounting 1
- Web/App Team 1

**Phase 7**

*Length*
1 Year

*Accomplishments*
- East Coast Market Penetration
- Advertising Budget Increase
- Multiple Product Lines
- Large Chain Accounts Obtained

**Sale Goals**
- Retail $5,677,500
- Whole Sale $3,132,600

*Job Creation*
- Customer Service 1
- Engineering 1
- Sales/Marketing 1
- Accounting 1
- Web/App Team 1

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GrabiTech Communications

**Time Line**

GTC uses a 7 phase plan to establish company structure, advertising budgets and employee hiring. Starting in Reno and expanding into multiple markets, cities and locations around the U.S.
Operating Controls

Standard Operating Procedures (SOPs) and Controls within the operation will be established to reduce and minimize the risk to GTC’s as a business. All contracts will be reviewed by an attorney and signed by all parties to verify agreements. The following five categories are areas of foreseen risk: quality control, accounting, payment, and liability.

Manufacturing and Quality Control: GTC will be outsourcing all manufacturing to KeyTronicEMS, a reputable vendor. GTC will send blueprint schematics and a bill of materials to China in order to create a quality, affordable, and compact device. Once the circuit boards are completed, KeyTronicEMS will test and integrate the circuit into a durable casing. The product will then be shipped back to GTC for secondary testing by GTC engineers. This two-step quality assurance process will ensure the highest standards. Once these steps are completed, inventory stocking and distribution can be executed.

Accounting: GTC employees will establish proper bookkeeping procedure and will ensure proper practices are maintained. GTC will establish a system for paying all taxes (including local, state, federal, and payroll taxes), applicable fees, and obtaining licensing (including business licenses). Also, GTC will confirm the preliminary budget and cash flow measures that are included in this business plan. If it is necessary, GTC will seek consulting from licensed accounting firms each tax period to verify GTC’s financial situations, and to seek advice on how to continually manage funds effectively. Financial industry standards will be followed such as the requirement of two signatures to reduce the risk of fraudulent activities within the company.

Payment: Payment from the sales of Tag n’ Grab will initially be direct from the customer to the company. Initially, consumers will purchase the finished product directly from GTC’s website or from online retail distributors such as Amazon.com. When retail partnerships are developed, payment arrangements will be negotiated with the retailer.

Liability: Tag n’ Grab will adhere to any FCC regulations, and GTC will purchase liability insurance in order to protect the company as well as the consumer. Legal consultation will be obtained to minimize the risk of liability in the form of lawsuits.

Regulatory Issues

Taxes: James Malone, GTC CFO, will complete all the necessary financial documents for taxes and fees. If necessary, external accounting firms will be consulted.

Licensure: A state license will be required for GTC to conduct business. GTC will consult with accounting and other professional in licensing specifics.

Quality Assurance: All products will be tested by KeyTronicEMS and further tested by engineers at GTC in a methodical two step quality assurance process. All manufacturing processes will be held to the highest regulations and standards.

Product Listing/Industrial Standards: If necessary, GTC will obtain UL certification, but will also meet all industry standards being a lead free product and RoHS compliant.
Projected Staff Expansion

**Customer Service**
- Customer Intimacy
- Order to Shipping Communication
- Account Assignments

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

**Engineering**
- New Product Design
- Quality Maintenance
- Sensor Development

<table>
<thead>
<tr>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

**Sales / Marketing**
- Customer Intimacy
- Establish Whole Sale Accounts
- Target Market Entry Points

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

**Shipping**
- Product Delivery
- Whole Sale Connection

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

**Accounting**
- Record Keeping
- Operation Analysis

<table>
<thead>
<tr>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

**Website / App Team**
- Website / App Maintenance
- Market Development

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

Projected Staff Increase of 19 by Year 5
VII. Marketing Strategies

Based on the Pew Research Center, Figure 14 determines that close to 9 in 10 smartphone owners (87%) use their phones to access the internet or email, with 78% of these users explaining that they go online using their phone on a typical day. In other words, on a typical day 68% of all smartphone users go online using their phone. With this information, the majority of GTC’s marketing efforts and will be spent on internet and smartphone accessible forms of advertising. GTC’s target age group is not only dependent on their smartphones, but also on the applications they choose to download. Many of these smartphone applications are gateways to thousands of potential customers.

Millennial Generation Marketing with Apps and Social Media

GTC’s has an aggressive advertising approach through smartphone applications. The gaming application market is an extremely trendy and competitive environment as there is a constant battle for the top spot as the most popular game. Many of the hottest applications of 2011 such as Draw Something, Fruit Ninja, Bejeweled, Words with Friends, and Scramble all have one thing in common: multiplayer functionality. These applications have an exponential growth in number of downloads due to the nature of their functionality: that is, users are unable to play by themselves and are only able to take full advantage of the application’s features by encouraging peers to download. As a result, there is a chain reaction with multiplayer type applications where an entire network of friends will be using the same application. GTC will have a dedicated team to keeping track of top applications available for download by constantly monitoring the “Top Apps” sections in Android and Apple application stores. These software developers will be contacted directly for advertising opportunities with Tag n’ Grab.

As shown in Figure 15, users 18-54 comprise 78% of the 425 million active mobile users across Facebook. Facebook currently offers cost per click (CPC) advertising, allowing GTC to specify a payment...
amount whenever a Facebook user clicks on a *Tag n’ Grab* advertisement. CPC advertising is extremely useful in fighting competing technology, but even more so against people from doing nothing. CPC advertising can be triggered where users can be taken directly to the application store to immediately download the *Tag n’ Grab* application. This will save users the hassle of manually accessing the application store, remembering the name of the application, and then taking time to search for it. In addition to Facebook, application enabled entertainment such as *Pandora*, *YouTube*, and *Reddit* will be considered as opportunities for advertisement. Figure 16 shows the listed services and entertainment.

**Figure 16: Potential Advertisement Outlets**

### Advertising by Generation

The target market age group of 18-54 can be further separated into two sub groups: generation X and the millennium generation. Each generation will have tailored advertising strategies. The millennium generation views technology as a necessity in day-to-day activities, and generation X utilizes new technology as toys or gadgets rather than a lifestyle. GTC will have a well-qualified sales team to advertise each specific market, and has decided to establish a sales group as an integral part of the business in developing customer intimacy. This would promote return customers ensuring GTC a solid source of revenue.

The sales team has several other marketing methods that can be used for all people in within the target age group of potential customers. One such method is the use of billboards. Thousands of cars drive on the freeway everyday so a billboard would be an excellent means of advertisement. The sales team can further advertise *Tag n’ Grab* using online banners on search engines like Google or Bing. Additionally, advertisements will be placed in strategic locations such as airports and hotels to attract potential busy customers. GTC will also have a fully functioning website to serve all customers and potential customers.
Distribution

GTC’s initial marketing strategy is to sell *Tag n’ Grab* directly to the consumer through GTC’s online website or online retailers that require monthly subscriptions such as *Amazon.com*. GTC will bring several samples of *Tag n’ Grab* and interchangeable sensors to industry trade shows, such as the annual *Consumer Electronics Show* (CES), where they will be introduced to consumers and potential retail partners. By year 1, GTC hopes to persuade multiple retail outlets carry *Tag n’ Grab* on their shelves. GTC will have a developed shipping department added as the number of accounts increase. Aside from minor costs associated with storage, distribution, and marketing of *Tag n’ Grab*, profit margins are vast, especially with *Tag n’ Grab* sensors. Table 3 shows the markup from Variable cost.

Table 3: Sensor Mark Up

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Total Variable</th>
<th>Retail Price</th>
<th>Retail Mark Up</th>
<th>Wholesale Price</th>
<th>Wholesale Mark Up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature Sensor</td>
<td>$0.2</td>
<td>$20</td>
<td>$19.8</td>
<td>$10</td>
<td>$9.8</td>
</tr>
<tr>
<td>Humidity Sensor</td>
<td>$1.72</td>
<td>$20</td>
<td>$18.28</td>
<td>$10</td>
<td>$8.28</td>
</tr>
<tr>
<td>Light Sensor</td>
<td>$3.42</td>
<td>$20</td>
<td>$16.58</td>
<td>$10</td>
<td>$6.58</td>
</tr>
<tr>
<td>Alcohol Sensor</td>
<td>$5</td>
<td>$25</td>
<td>$20.0</td>
<td>$15</td>
<td>$10</td>
</tr>
<tr>
<td>Natural Gas Sensor</td>
<td>$5</td>
<td>$25</td>
<td>$20.0</td>
<td>$15</td>
<td>$10</td>
</tr>
</tbody>
</table>
VIII. Critical Risks

<table>
<thead>
<tr>
<th>Risk</th>
<th>Risk Level</th>
<th>Recommended Controls</th>
<th>Action Priority</th>
<th>Selected Planned Controls</th>
<th>Required Resources</th>
<th>Responsible Team Member</th>
<th>Start Date/End Date</th>
<th>Maintenance Requirement/Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creating Product</td>
<td>High</td>
<td>-Design -Testing -Functionality</td>
<td>High</td>
<td>-Quality assurance -Tech advancement -Implement</td>
<td>5 months time Product design parts</td>
<td>-Cho -Victor -Justin -Felicia</td>
<td>-Start: Month 1 -End: Month 2</td>
<td>-Quality department -Random testing -Upgrades</td>
</tr>
<tr>
<td>Android App Design</td>
<td>High</td>
<td>-Develop App -User friendly -Testing</td>
<td>High</td>
<td>-Control group -Graphical user interface (GUI) -Debugging</td>
<td>-App Team -Customer service</td>
<td>-James -Justin -Felicia</td>
<td>Ongoing</td>
<td>-Team to analyze customer comments -Updates continually to keep up with expanding market</td>
</tr>
<tr>
<td>Underestimate Cost of Production</td>
<td>High</td>
<td>-Order larger Quantities -Outsource</td>
<td>Medium</td>
<td>-Break even analysis -Job costing by margin to assess cost control</td>
<td>-Cash to order larger quantities -Inventory Storage space</td>
<td>-James -Justin</td>
<td>-Start: Beginning 2nd year -End: Ongoing</td>
<td>-Profits with as little as .05% market -May want to evaluate hiring advertising agencies</td>
</tr>
<tr>
<td>iPhone App Implementation</td>
<td>Medium</td>
<td>-Testing -Develop app -User friendly</td>
<td>Medium</td>
<td>-Control group -Graphical user interface (GUI) -Debugging</td>
<td>-App team -Customer service -Apple proprietary fees</td>
<td>-Cho -Victor</td>
<td>-Start: Beginning 1st year -End: 2nd year</td>
<td>-Team to analyze customer comments -Updates continually to keep up with expanding market</td>
</tr>
<tr>
<td>Unit Size</td>
<td>Medium</td>
<td>-Smaller microprocessor -Smaller casing</td>
<td>Medium</td>
<td>-Continually improve on unit size and casing style</td>
<td>-Testing costs -Prototype/ component materials costs</td>
<td>-Cho -Justin -Felicia -Victor</td>
<td>Ongoing</td>
<td>-Quality department -Keeping casing style popular for market demand</td>
</tr>
</tbody>
</table>

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IX. Income Statement

GTC will start as a LLC but plans making public offer at year 5. GTC requires the start-up loan of $500,000 and share sells of $700,000. This will be the fuel that drives GTC’s ability to create and sell to the targeted audiences. In Year 3 GTC plans to breakeven and the use the surplus to pay all long term liabilities. A sales goal of $9,000,000 by the end of year 5 and cash balance of $7,000,000 will glorify our financials for public offers. An FCC approved catalog will be available by the end of year 5 to establish large inventories from public stock shares. With the up-to-date technical skills from GTC’s engineering team, a current and recognizable product line will lead the smartphone personal notification industry.

GTC income is produced by sales of the Tag n’ Grab product line. Upon review of the market segmentation, GTC estimates the ability to sell the Tag n’ Grab base kits as well as the expansion kits for $50.00 and $25.00 respectively. Consumer sells increase profit margins.

A breakeven analysis is used to determine when the total revenue earned is equal to the costs associated with the total revenue. Figure 18 is the breakeven analysis for GTC’s five year plan. GTC projects to breakeven after the 6th month of year 3.
X. Cash Flow Statement

GTC is a small asset startup. Computer equipment, storage racks and R&D tools is all that is required. Because GTC plans to start with high capital we are able to perform and build operations without running low on Cash. This is essential in the survival of the company for the first 3 years. After year 3 our cash balance will rise and GTC will have additional capital to invest further into the company.

XI. Funds Required/Used

Funds required for business start is $1,250,000. This will give us a large enough balance to perform all our operations. Below is a graph projecting Sales Profit over the next five years. By Year 5 we forecast a profit of 63.8 Million.

![Figure 19: Gross Sales Over the First 5 Years](image-url)
XII. References

Companies/Products researched:
2) Tree House LLC http://www.bikin.com

Research Information
2) http://www.census.gov/prod/cen2010/briefs/c2010br-03.pdf (Total population of smartphone users was referenced with 2010 census)
3) http://venturebeat.com/2012/02/01/facebooks-monster-mobile-numbers-over-425m-users-across-android-ios-other-platforms/