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Motivating Energy and Resource Conservation Behavior by Gamification

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Abstract Gamification is the use of game thinking and game mechanics in a non-game context to engage users and solve problems. The project, Motivating Energy and Resource Conservation Behavior by Gamification, is to complement the area about gamification effect on motivating energy savings. In this project, we are designing a web game called Castle War which implements the electricity usage and water usage data from the Smart Housing Project of Clarkson University. The game is designed to be a war game that can engage every resident from the Smart Housing Project. The resident who saves more energy on that day, will get more currency to spend in the game on that day. The players can use the game currency to build their own empires while at the same time form unions to battle with others. In addition, the game elements will be closely related to the environmental-friendly topic. The real world concept of carrying capacity of environment, the tradeoff between development and pollution will be reflected in this game. This project will be a great addition to the research area that involves how the computer-based virtual world engagement of gamified system would motivate the real world energy consumption behavior.

Keywords Gamification, Motivating Energy, Resource Conservation

1. Introduction

Gamification is the use of game thinking and game mechanics in a non-game context to engage users and solve problems. It has been defined “as a process enhancing services with (motivational) affordances in order to invoke gameful experiences and further behavioral outcomes.[1]. Human brain is brought to enjoy these motivational activities which will become an intervention to facilitate people to do certain actions. The idea of combining gamification and energy conservation has become a hot topic in this area in recent years.

2. Methodology

In the Project Motivating Energy and Resource Conservation Behavior by Gamification, the methodology we used was to design a web game called Castle War which implemented the electricity usage and water usage data from the Smart Housing Project of Clarkson University, which was a very innovative method to utilize the concept of gamifications. The game was designed to be a war game that could engage every resident from the Smart Housing Project. Since there were multiple sensors in each apartment to record the daily electricity usage and water usage, we were able to use the real-time resource consumption data in the game. The ultimate idea of this game was the player who saves more energy on a day, he would have more game currency to spend for that day. The players could use the game currency to build their own empires while at the same time form unions to battle with others. They could build different types of buildings, produce a variety of soldiers in order to utilize multiple development strategies. The game elements were closely related to the environmental-friendly topic. The real world concept of carrying capacity of environment, the tradeoff between development and pollution would be reflected in this game as well.

3. *Castle War* Game Rule

Top Level

1. Game Currency
2. Battles
3. Union
4. Buildings
5. Soldiers
6. Game Supplement Tools
7. Ranking Board
8. Game Background changes

3.1. Game Currency

At the beginning of the game, every player has 0 soldier and $30000 money.

Every player will get an amount of game currency for every day, according to the following formula:

$(20000 - Electricity Usage on that day(unit : Watt Hour) *3.6 - Cold Water Usage on that day (unit: gallon)*5 – Hot Water Usage on that day (gallon)*10) + (Difference between Average Daily Electricity Usage last week and Electricity Usage on that day) *10 + （Difference between Average Daily Water Usage last week and Water Usage on that day） *200

This formula is made up of two parts.

- Part 1, the basic part is $(20000 - Electricity Usage on that day(unit : Watt Hour) *3.6 - Cold Water Usage on that day (unit: gallon)*50 – Hot Water Usage on that day (gallon)*100). This formula exists because the player who saves more energy on that day, he will get more currency in the game for that day. Since the hot water not only consumes water energy, but also consumes heat energy, it should be weighted more in the calculations.
- Part 2, the bonus part is (Difference between Average Daily Electricity Usage last week and Electricity Usage on that day) *10 + (Difference between Average Daily Water Usage last week and Water Usage on that day) *200. If one of the differences is less than 0, then that part of difference will be treated as 0.

3.2. Battles

(1) If a player attacks his opponent's castle actively and wins the battle, he will own 1/8 of the money that his opponent has at the time. If a player attacks his opponent's castle actively and wins in two consecutive battles, he will own 1/4 of the money that his opponent has at the time. One player can only attack the same opponent once a day. One player can't attack the same opponent more than 2 times within 15 days. Every time after each battle, the soldiers from both sides of the players will suffer some fatigue, which means the attack power and defense power need to multiply by the fatigue coefficient 0.95 for two days(If a player has n battles a day, his soldiers' attack power and defense power need to multiply by 0.95^n for two days).

A player will be automatically protected from attacking if he lost the defense battles 3 times a day. This rule exists to protect the players from suffering major loss in a day.

(2) Attack Power: the total attack power is

(a player's soldier's attack power combined * effectiveness coefficient* fatigue coefficient*power efficient) when his army is attacking other player's castle.

Defense Power: the total defense power is (a player's soldier's defense power combined * effectiveness coefficient * fatigue coefficient*power efficient) when he defends his castle from other player's attack.

During each battle, the attacking player's attack power should be higher than the defending player's defense power in order to win the battle. Each time a player wins a battle in offense or defense, his status will be upgraded to one higher level. (There is no limitation on the highest level a player can achieve.)

Tiebreaker: if they are the same, then compare (1) Level (2) Money (3) Total number of Soldiers

In order to encourage offense, the attacking player will only lose 2% of his money if he loses the battle each time.

When a player wants to find an opponent to attack on the map, he can only see his opponent's user name. He can't see the opponent's level, total defense power, money unless he uses a spy. Each player can use three spies once per day. And each spy will cost the player $1000 to train and can only be used once. This rule exists to increase the uncertainty of the game.

If a player's electricity usage is less than the medium this week, his soldiers' power next week multiply a power coefficient which is equal to: medium electricity usage / actual electricity usage. Otherwise the power coefficient is equal to 1. This rule exists to award the players who use less energy than the medium level.

(3) If the money/number of soldier ratio is less than 100:1, it means the carrying capacity of the castle is over limit. Therefore,

If the money/number of soldier ratio is less than 100:1, then the soldier will be 90% of effectiveness.

If the money/number of soldier ratio is less than 80:1, then the soldier will be 80% of effectiveness.

If the money/number of soldier ratio is less than 70:1, then the soldier will be 70% of effectiveness.

This rule exists because we don't want the players to produce as more soldiers as possible, instead we want them to notice that each type of environment has certain capacity.

3.3. Union

(1) At most 4 players and at least 2 players can form a union. A player can get financial supply from other players within the same union. (at most once every three days. Every time should get less than or equal to 5% of his own fortune) **In order to encourage players to form union, the players who join a union their overall attack power and defense power will be increased by 2%.**

A member can be kicked out of the union if the rest of the members from that union all agree.

A union can be dissolved if half or more than half of the members from that union agree.

A member can decide to withdraw from the union anytime he wants to.

(2) A player can trade his money for soldiers or trade his soldier for money with other players from the same union.

For the trading with another player, buying an infantry will receive a discount of 20% of the original price, buying a knight will receive a discount of 10% of the original price

Selling an infantry will only get 80% of its original price money, selling a knight will only get 90% of its original price money.

(3) A battle between two unions will only happen if these two unions are made up of same number of players. If a union attacks his opponent union actively and win in two consecutive battles, they will own 1/8 the money that his opponent union has as a whole and distributed equally to each member of the union. One union can only attack the same opponent union once a day. One union can't have battles with another union more than 2 times within 15 days. The rule for winning the battle is the same as the battle between individuals. Each player from the winning side his castle will be upgraded to one higher level.

3.4. Buildings

1. **Main Castle**: every player will get a main castle at the beginning of the game, it is used to produce soldiers. Every player can only has one main castle. The main castle will be destroyed if the player loses the battles 30 times when other players attack his castle, which means that the player should start a new game from the beginning.

2. **Weapon Factory**: The Weapon Factory is for increasing the attack power of the soldiers. It cost $5,000 money to build. When the player builds one weapon factory, his soldier will improve their attack power of by 2%.

3. **Temple**：Building a Temple can increase both attack power and defense power by 1%. A temple will cost $7000 money.

4**. Banking Center**: The banking center is for save the costing of feeding all the soldiers. If the player builds one banking center, the costing of feeding the soldiers will be down 2%. A player can have 4 banking centers at most. A banking center will cost $8,000 money.

5. **Watchtower:** If a player builds a Watchtower, his army's total defense power will be increased by 2%. Each Watchtower will cost $4,000 money.

6. **Sewage Treatment Plant (Environmental-friendly):** If a player builds a Sewage Treatment Plant, his soldiers' effectiveness will be increased by 1% because the castle's environment will be better. Each Sewage Treatment Plant will cost $6,000 money.

3.5. Soldiers:

Gold Knight: Attack Power: 100, Defend power: 90
Price: $500 per Gold Knight
Daily Cost: $50 per Gold Knight

Silver Knight: Attack Power: 80 Defend power: 80
Price: $400 per Silver Knight
Daily Cost: $45 per Silver Knight

Standard Knight: Attack Power: 70, Defend power: 75
Price: $350 per Standard Knight
Daily Cost: $40 per Standard Knight

Standard Infantry: Attack Power 40, Defend power 30
Price: $200 per infantry
Daily Cost: $20 per infantry

Spy

Each spy will cost a player $1000 to train, and a player can only train three spies a day. Spy can help the player to scout the opponent's money, soldier, and effectiveness. Each spy can only be used once and spy cannot be traded.

3.6. Game Supplement Tools:

Growing Corn: Each Corn field costs $2,000 money and this will cost the player $200 money each day to maintain.

Every Corn field will increase the solder's effectiveness/morale for 0.5% because the soldiers will get more food supply.

If the player lost two or more battles on a day when he is defending, he will lost all the effectiveness that corns generated for the next three days.

Mines: Each Mine cost a player $5,000, and it will produce $500 a day. However, since mining will pollute the environment, so each mine the player build will decrease the effectiveness of the soldiers by 0.5%.

If the player lost more than one battles on a day when he is defending, he will lost all the money the mine generated that day.

Trees: Each tree costs $200 money and needs $100 to maintain each day. The more tree a player plants, the better environment the player has, so the effectiveness of the soldier will increase. Planting one tree will increase the effectiveness of the soldier by 0.05% and the effectiveness won't be disappeared even if the player loses the battle when he is defending.

Electric Tank (Environmental Friendly)

Each Electric Tank will cost the player $3000 to manufacture. The daily maintenance fee for Electric Tank fee is $200 since it is environmental friendly, the cost of electricity is much cheaper than the traditional tank. Each Electric tank will improve the soldiers' offense and defense power by 0.5%.

Traditional Tank

Each Traditional Tank will cost the player $800 to manufacture. The daily maintenance fee for Electric Tank fee is $300. Each traditional tank will improve the soldiers' offense and defense power by 0.3%

3.7. Ranking

At the end of the semester, the TOP 2 players who have most game currency will be the ultimate winner

Tiebreaker: Money> Total number of Soldiers> Number of Knights

3.8. Game Background Changes

During the game, according to the effectiveness of the player's soldiers, the player's castle will be placed in a more forested area if his soldiers have higher effectiveness, the player's castle will be placed in a less forested area if his soldiers have lower effectiveness.

In the game map, the single player who has higher effectiveness and the union who has average higher effectiveness will be placed in the north region of the game map, while the single player who has lower effectiveness and the union who has average lower effectiveness will be placed in the south region of the game map.

4. Sample Data Collection

For this project, I collected and processed the energy usage data of electricity and water usage from the Smart Housing Project at Clarkson University for academic year 2013- 2014 and 2014 to 2015.

4.1. Electricity Usage

I choose the data from Apartment 1011(4 bedroom type) and Apartment 1021 (6 bedroom types) for academic year 2013-2014 and 2014 to 2015. (Note: The summer breaks started in May and ended in August while the winter break started in December and ended in the beginning of January, so the electricity usage in May, December and January may be less than the other months without major long breaks.) From the processed data we can see typically for a smart housing project resident, the average daily electricity usage from respective months is mostly within the range from 1200 watt hour to 2500 watt hour.

The result is shown below:

Apartment 1011:

Average Daily Electricity Usage for a person living in smart housing project in 2013-2014 academic year.

Unit: Watt Hour

Month	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	Apr.	May
Monthly Sum	165472	236159	188837	116885	175070	167174	151963	195459	49927
number of students	4	4	4	4	4	4	4	4	4
number of days in that month	30	31	30	31	31	28	31	30	31
average electricity usage (watt hour) per day per person	1378	1904	1573	942	1411	1492	1225	1628	402

Average Daily Electricity Usage for a person living in smart housing project in 2014-2015 academic year.

Unit: Watt Hour

Month	August	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	Apr.	May
Monthly Sum	100869	272709	296585	223798	1890	179551	179856	157976	218958	35941
number of students	4	4	4	4	4	4	4	4	4	4
number of days in that month	31	30	31	30	31	31	30	31	30	31
average electricity usage (watt hour) per day per person	813	2272	2391	1864	15	1447	1498	1274	1824	289

We can see that from 2013-2014 academic year to 2014-2015 academic year, the average electricity usage per day per person in Apartment 1021 is slightly increased.

Apartment 1021:

Average Daily Electricity Usage for a person living in smart housing project in 2013-2014 academic year.

Unit: Watt Hour

unit watt hour for 2013-2014 school year	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	Apr.	May
Monthly Sum	320894	355477	353784	205170	298034	385303	391988	415404	112917
number of students:	6	6	6	6	6	6	6	6	6
number of days in that month	30	31	30	31	31	28	31	30	31
average electricity usage (watt hour) per day per person	1782	1911	1965	1103	1602	2293	2107	2307	607

Average Daily Electricity Usage for a person living in smart housing project in 2014-2015 academic year.

Unit: Watt Hour

Month	August	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May
Monthly Sum	122268	348296	352806	248028	1267	252158	278437	251241	343398	103017
number of students:	6	6	6	6	6	6	6	6	6	6
number of days in that month	31	30	31	30	31	31	28	31	30	31
average electricity usage (watt hour) per day per person	657	1934	1896	1377	6	1355	1657	1350	1907	553

We can see that from 2013-2014 academic year to 2014-2015 academic year, the average electricity usage per day per person in Apartment 1021 is slightly decreased.

4.2. Water Usage

For the water usage, I randomly choose 8 sample days from 4 different apartments for the academic year 2013 to 2014 or 2014 to 2015 and calculate the average water usage per person for that day. All the apartments I investigate are 4 bedroom types.

Average Daily Water Usage for a Person Living in Smart Housing Project

Unit: gallon

Apartment NO.	Sample Day 1	Sample Day 2	Sample Day 3	Sample Day 4	Sample Day 5	Sample Day 6	Sample Day 7	Sample Day 8
1011	28.35	24.25	22.00	29.25	30.18	23.75	17.25	35.65
8031	71.33	61.75	42.95	54.75	49.55	53.10	53.73	33.05
8041	24.28	27.50	15.00	20.73	23.88	71.75	27.78	20.98
8052	42.15	25.88	23.90	37.20	22.93	22.25	26.93	23.48

From the result, I can see the daily water usage per person is mostly within the range from 20 gallons to 70 gallons. (Usually 50% -70% of the water consume is hot water).

Apartment 8031 consumed much more water every day than other apartments.

Using the game currency formula from the rule, if a player consumes 1200 watt-hours electricity, and 30 gallons water for a day (assume 50% of the water is hot water), the money in the game he will gain is 20000-1200*3.6 – 15*50 – 15*100=13430. For the second player, if the average daily electricity usage last week is 1300 watt-hours, and average daily water usage is 40 gallons, then he will get the bonus game currency for that day: 100*10+ 10*200= 3000. The overall game currency he will get for that day is 13430+3000= 16430.

5. Project Literature Review

The key papers in this field are relatively rare since very few papers actually connect the effects of gamification to the energy conservation. But there are still some good papers providing some valuable research result about gamification which provides great fundamental information for this project.

Gamification: The Intersection between Behavior Analysis and Game Design Technologies

Zachary H. Morford & Benjamin N. Witts &
Kenneth J. Killingsworth & Mark P. Alavosius
http://link.springer.com/article/10.1007/s40614-014-0006-1

In this paper, the author list several examples of gamification, which cover different fields of applications for gamification such as in the field of behavioral health and fitness, environmental sustainability and technologies for teaching while my project focuses on the energy conservation and environmental sustainability.

5.1. Behavioral Health and Fitness

Gamification applied to issues related to health and fitness is possibly the most common area of application for gamification. The styles of games included fast-paced activity games such as Dance Dance Revolution, and role-playing games where players take the part of a character in a story. Another application of gamification to fitness is the Zombies, Run! application (Six to Start 2012). Downloadable for android and iPhone, this app utilized interactive storytelling and a variety of rewards to increase the frequency of users' real-world running. The rewards can be used to improve the living conditions for a virtual group of zombie-apocalypse survivors.

5.2. Environmental Sustainability

A company named Cool Choices which designed a mobile application to create lasting behavior change related to electricity conservation, water conservation, and driving efficiency. The game was played by teams of employees over the course of 6 months. Individuals earned points by posting photos and stories about their actions, and the way to earn points was based on the monetary savings of the activity and the difficulty of the task. Cash prizes were provided for individuals and teams with the highest scores. The authors report that Cool Choices is projected to reduce electrical, water, gasoline, and natural gas consumption.

5.3. Technologies for Teaching

An example of gamification in education is the computerized reading program MimioSprout (formerly known as Headsprout Early Reading and Headsprout Reading Comprehension programs). MimioSprout guarantees that a nonreader or beginning reader will read at a first grade reading proficiency in fewer than 30 h of individualized online instruction (Mimio, n.d.). In MimioSprout's programs, many of the learning sequences are presented in a game context, where each level increases in difficulty based on the student's performance. Students can progress through the program with minimal adult supervision. Students receiving both MimioSprout and traditional reading instruction outperform students who receive only traditional reading instruction. A randomly selected group of first graders at one New York public school received 30 h of supplemental MimioSprout training and performed 0.35–0.75 grade levels higher on standardized tests than students who received traditional instruction only

5.4. Other Examples of Gamification

Microsoft developed a program called Ribbon Hero that gamifies the process of learning how to use Microsoft Office suite.

A User-Centered Theoretical Framework for Meaningful Gamification

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http://www.quilageo.com/wp-content/uploads/2013/07/Framework-for-Meaningful-Gamifications.pdf

In this paper, the author explains the definition of gamification and the influence of external motivation on the internal motivation of the users. If the game design elements can be made meaningful to the user through information, then internal motivation can be improved as there is less need to emphasize external rewards. Gamification is the "use of game design elements in non-game contexts" (Deterding et al, 2011, p.1). A frequently used model for gamification is to equate an activity in the non-game context with points and have external rewards for reaching specified point thresholds. The author thought the external rewards unrelated to the activity are the least likely to be integrated, so it may be harmful that these controlling aspects will make the user lose internal motivation. And it is beneficial if the users can set their own goals in the game since the user is more capable to connect these goals to other values he or she already holds. This article provides beneficial information for the project *Motivating Energy and Resource Conservation Behavior by Gamification* when we are considering if we should give monetary or other types of external awards as a prize for the ultimate winner of the game Castle Wars. According to the conclusion of the paper, we may give the external award which will be relevant to the game element in order to prevent the negative effects from the irrelevant external awards.

Using Gamification to Reduce Energy Use – Locked Martin Carbon Footprint Reduction Game

http://www.lockheedmartin.com/us/news/features/2014/gamification-energy-use.html

The Carbon Footprint Reduction Game which was developed by Locked Martin not only helps users have fun, it's also a potential solution to serious problems like managing skyrocketing global energy consumption. The game utilized the concept of gamification, but it was more like a real world action game that encourages the players to shrink their carbon footprint. In the project *Motivating Energy and Resource Conservation Behavior by Gamification,* we wanted the players to engage in a competitive war game that also operated in the mobile app or computer platform. The scoring system was also implemented in the game for ranking as an in-game reward.

6. Education, Action, Analytics

Designed for use on mobile devices and desktop computers, the Carbon Footprint Reduction Game splits the gamification process into 3 components.

1. Education: Users score points in the game by watching educational videos on energy use reduction.

2. Action: Game users take real-world actions to shrink their carbon footprint. They'll receive in-game rewards for installing programmable thermostats, energy efficient light bulbs and sharing their thoughts on what matters most to them in energy conservation.

3. Analytics: As individuals work to become more energy efficient game sponsors in government and industry can learn about end-user attitudes towards energy conservation through in-game analytics and fine tune their outreach for success.

Does Gamification Work? — A Literature Review of Empirical Studies on Gamification

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http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6758978

This article not only covers results, independent variables (examined motivational affordances), dependent variables (examined psychological/behavioral outcomes from gamification), the contexts of gamification, and types of studies performed on the gamified systems, but also examines the state of current research on the topic and points out gaps in existing literature. It also illustrates the positive results that gamification delivers, but many times the effect is dependent on the context that the gamification is implemented.

Gamified Energy Efficiency Programs

Frederick Grossberg, Mariel Wolfson, Susan Mazur-Stommen, Kate Farley, and Steven Nadel February 2015 Report Number B1501

http://aceee.org/research-report/b1501

In this report the authors collected information on 53 games for this study, all of them meant to influence behavior around energy efficiency and sustainability. Of these 53, we present case studies of 22 games that could be or actually are part of a utility energy efficiency program.

1. COOL CHOICES [2]

Cool Choices is a Wisconsin nonprofit that creates sustainability-focused games. They develop a game called iChoose in April 22 (Earth Day), 2011 for Miron Construction. This game ran for six months and involved 220 Miron employees out of a total of 330. Players received a new deck of action cards every month, with each card featuring a specific sustainability-focused action. Each month had a theme: household energy (electricity and natural gas), transportation, water, waste, and indoor environmental quality. Cool Choices had a website for players to log their actions to receive points, follow a leaderboard, and see updates from their coworkers. Based on the ECW evaluation and other data, Cool Choices estimates that players in its Midwest games save an average of 390 kWh of electricity, 10 therms of natural gas, 20 gallons of gasoline, and 645 gallons of water.

This game is said to be the first real gamification project that related to the energy conservation and environmental sustainability. Compare to the project *Motivating Energy and Resource Conservation Behavior by Gamification* that we have been working on, it lacked the necessary gameful element and experience, which makes it more like a program that instruct people to save energy through some actions in order to receive awards.

2. POWER AGENT [3]

Power Agent was a Swedish pilot project which was implemented in the spring of 2008. Two teams each comprised of a family with teenagers were asked to compete for 10 days to achieve the greatest relative reduction in electricity consumption. There will be an automatic meter reading system collected real-time data on household electricity use. This game was played on the mobile phone. The players need to follow the manager's instruction to complete certain task such as unplugging wall sockets to prevent the DVD or the stereo from using electricity when not in use. At the end of the game, all players received a summary from Mr. Q on their phones, which included not only their 10-day performance record, but also the potential energy and financial savings if they continued the same behaviors over an entire year.

Compare to the project *Motivating Energy and Resource Conservation Behavior by Gamification* that we have been working on, it also lacked the necessary gameful element and experience. The POWER AGENT project last only 10 days, and it was more like an energy competitions with sequential instructions to follow rather than a real gamification project.

3. THE KUKUI CUP [4]

The 2011 Kukui Cup was an energy-saving competition for undergraduate students living in dormitories at the University of Hawaii at Manoa. The researchers developed two open-source software infrastructures for the game: Watt Depot, which they used to collect, store, analyze, and visualize electricity data, and Makahiki, a platform (including a website) for the competition that could eventually be customized for other organizations' energy challenges. Teams of students, divided by dormitory floors, competed in two ways: first, to consume the lowest absolute amount of electricity as a floor (the Go Low competition), and second, to accumulate the most points based on their completion of a variety of sustainability-focused activities (the Get Nutz competition). Only individuals could earn points, but they could pool their points with those of their teammates. The competition had three rounds, each lasting one week. Players could compete in one, two, or all three rounds. Prizes were awarded to the winners of each round, both to the dorm floor that saved the most energy and to the individual who scored the most points.

The KUKUI CUP project is by far the project which is most similar to the project *Motivating Energy and Resource Conservation Behavior by Gamification* that we have been working on. It has similar fundamental infrastructure that the Smart Housing Project at Clarkson University has for energy usage monitoring. It also holds the idea to award the students who save the most energy. However, in the project *Motivating Energy and Resource Conservation Behavior by Gamification* that we have been working on, we want the students to engage in a virtual gameful experience which people who save more energy will have more game currency to spend in the game. And people who have the most gameful currency from daily energy savings will have the bigger chance to become the ultimate winner in the end. We think our project will be a great addition for the previous gamification research and highlight how the computer-based virtual world engagement of gamified system would motivate the real world energy consumption behavior.

7. Future Work

The game *Castle War* needs to be implemented for use on mobile devices and desktop computers.

We should keep track of the average electricity & water usage every week to see if the energy consumption is trending down compared to the beginning of the semester.

It is suggested that the Unity Game Engine is a very good platform to design and implement games like this. And it will be very beneficial if we can get a professional web graphics designer to design the unique characters and elements like soldiers and buildings to make this game more appealing to the players.

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