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Appraise of Multifarious Devices for Navigation

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Abstract – *Navigation systems from home searches originate from the fact that the user is stationary and hence can devote all of their senses to the visual application of navigation, whereas in case of a wearable device and mobile navigation the user devotes their visual resource of interaction when in motion. Augmented reality proved to be a solution for navigation but is restricted due to usability only for a small area. A wearable computer system with see-through display, digital compass, and a differential GPS are used to provide visual clues while performing an orienting task. With increasing demandfor user-friendly navigation which requires less amount of human interaction while driving, there has been a need for developing new navigation systems. These new devices must require less interaction with display screens, LCDs, and other output devices. For better user interface and handling pairing with mobile phones shouldn't be a novel task requiring a lot of human energy. Thus a paradigm shift needs to be implemented for better efficient navigation in everyday tasks. Below provided content is an overview of some of the possible ways to adopt new navigation based systems using wearables in our day to day life. These mentioned wearables perform the task with the assistance of navigation while driving, walking, and jogging in our daily commute.*

Key Words: Wearable devices, GPS, Geomagnetic sensor, Helmet, Watch, Bluetooth, Display, Navigation, Transport.

1. INTRODUCTION

More than 50% of the world population use road as their primary mode of transport. With a number so large, chaos is always around every corner. For all types of vehicle users there is sometime or another need for navigation, especially for 2 wheelers. Usually, we use voice assisted navigation systems or navigation guidelines displayed on a mobile phone.

For desk based navigation we rely on keyboard and mouse as the mode of interaction which quite tedious task. Some navigation systems are installed on a dashboard which needs our explicit attention to make driving decisions. With the number of road users increasing rapidly, there is a need for adopting a better and efficient navigation method. No navigation system present today can be deemed ergonomically proper during road commute, especially for mopeds and 2 wheelers. With this thought in mind, a smart wearable device could be the answer to such problems. A smart wearable device comes into play at this stage. With the number of road users increasing rapidly, there is a need for adopting a better and efficient navigation method. No navigation system present today can be deemed ergonomically proper during road commute, especially for mopeds and 2 wheelers. With this thought in mind a smart wearable device could be the answer to such problems. Major transport companies like Ola, Uber, and Lyft have an increasing percent of road accidents every year due to distraction while driving which mainly occurs due to constant interaction with the mobile phone navigation or dashboard mounted navigation systems. Risk involvement is quite high for two wheeler users who neither possess safety of that of a four wheeler nor do have a proper navigation mount system. In the near future where automated vehicle or driverless vehicles look to take over the roads a highly efficient navigation system needs to be implemented in order to obtain an ergonomically safe system.

The main objective of this paper is designing a system which is less time consuming during traveling, better adaptable with changing roads, effective & safe interaction between human and thing/device. As more number of people opt for road transport for their daily commute a self- evolving navigation system is necessary. With the increasing cost of fossil fuel and its depleting resources even a small mistake in understanding the road would lead to unnecessary burning of fuel in turn increasing the amount of CO2 (Carbon dioxide) and straining our resources. Around the world it has been found that yearly more than 2 Lakh litres of fuel is wasted due to incorrect navigation. Keeping these problems in mind an improvised navigation system based on human wearable devices need to be developed.

2. MOTIVATION

As more number of people opt for road transport for their daily commute a self-evolving navigation system is necessary. With the increasing cost of fossil fuel and its depleting resources even a small mistake in understanding the road would lead to unnecessary burning of fuel in turn increasing the amount of CO2 (Carbon dioxide) and straining our resources. Around the world it has been found that yearly more than 2 Lakh liters of fuel is wasted due to incorrect navigation. Keeping these problems in mind an improvised navigation system based on human wearable devices need to be developed.

3. LITERATURE SURVEY

The wearable device performs the task of navigation and helps user's to reach their destination. [1]This device does not require any additional information to be downloaded from

the internet, therefore, the overhead of data usage is less but maps should be downloaded before starting navigation. This system consists of android based smartphone application and finger sleeve device. The device connects to a smartphone with the help of Bluetooth so HC- 05 is used alternatively we can use BLE (Bluetooth Low Energy) module. The computational tasks are performed by the ATmega168 microcontroller. Two micro vibrators (left and right) are used to provide vibrational indicator w.r.t direction. This device can be used for visually impaired but unable to detect the obstacles.

The [2] Pocket Navigator which is vibro tactile navigation. It adds tactile feedback to simple but potent map-based navigation system that runs on an Android smartphone. It uses the tactile compass to tell them in which direction user should go and not how to turn at some decision points. It uses two pulses to encode the direction of the waypoint. For the straight waypoint two, equally short pulses are generated. If the waypoint is to the right, the second pulse becomes larger while if the first pulse is larger then it indicates waypoint is to the left. If the three pulses are generated instead of two then it is an exceptional case which indicates the waypoint is behind the user.

Belt-type wearable tactile display for navigation. The main concept of [3] this ActiveBelt is a tactile display which helps the user to intuitively obtain directional information, Belt-type wearable device optimized for mobile use. The system consists of a GPS, a microcomputer, a directional sensor and ActiveBelt hardware. The directional sensor consists of two sensors which are a geomagnetic sensor and an acceleration sensor which helps to detect the orientation of the user. Multiple vibrators are used to transmit tactile information.

Bruce Thomas, Victor Demczuk, Wayne Piekarski, David Hepworth, and Bernard Gunther [10] has discussed the visual navigation to the user. A wearable computer with a see-through display, digital compass and GPS are used to provide visual indication while navigation. Navigation involves direction finding, measuring distance and path finding. Position can be found by reference to the map while the direction is assessed by use of a magnetic compass. Distance can be calculated by time calculations.

Table -1: Comparative Study

Sr.no	Name of Researcher, Year of Publication	Paper Title	Methodology Adopted	Observations noted
1	Hemant Bhaskar Surale 2015	Finger Sleeve: A Wearable Navigation Device	The wearable device which will navigate the user to reach their destination. This system consists of android based smartphone application and finger sleeve device. The device connects to a smartphone with the help of Bluetooth so HC-05 is used. ATmega168 microcontroller performs computational tasks. Two micro vibrators (left and right) are used to provide vibrational indicator w.r.t direction.	Device operates on minimal number of steps. Offline navigation once map has been downloaded. Data connectivity. But complex topography roads. Cars with GPS enabled dashboards. This device can be used for visually impaired but unable to detect the obstacles
2	Koji Tsukada Michiaki Yasumra 2004	ActiveBelt: Belt-type Wearable Tactile Display for Directional Navigation	The main concept of this ActiveBelt is a tactile display which helps the user to intuitively obtain directional information. The system consists of a GPS, a microcomputer, a directional sensor and ActiveBelt hardware. The directional sensor consists of two sensors which are a geomagnetic sensor and an acceleration sensor which helps to detect the orientation of the user. Multiple vibrators are used to transmit tactile information.	Proposes tactile display for navigation. Using tactile sense obtain multiple direction information but its disadvantage need to manage different modules of the system. Belt-type wearable device optimized for mobile use.
3	Martin Pielot, Susanne Boll,	PocketNavigator: Vibro-Tactile Waypoint Navigation for	The Pocket Navigator [2] which is vibro tactile navigation. It uses the tactile compass to tell them in	Use of android application provides ease of usage and

	Benjamin Poppinga 2010	Everyday Mobile Devices	which direction user should go and not how to turn at some decision points. It uses two pulses to encode the direction of the waypoint. For the straight waypoint two, equally short pulses are generated. If the waypoint is to the right, the second pulse becomes larger while if the first pulse is larger then it indicates waypoint is to the left. If the three pulses are generated instead of two then it is an exceptional case which indicates the waypoint is behind the user.	better. Use of tactile compass to tell the direction. Its disadvantage is vibration pattern may confuse user.
4	Masakazu Miyamae Tsutomu Terada Yasue Kishino Shojiro Nishio Masahiko Tsukamoto 2005	An Event-driven Navigation Platform for Wearable Computing Environments	Wearable computing [8] has characteristics such as hands free, always on, supporting daily life. They used input buttons for user operations, GPS, geomagnetic sensor, wearable computer, HMD. GPS is placed on user's shoulder, wearable computer is placed in the backpack and geomagnetic sensor is attached to the HMD.	A new language is used to avoid interference with other systems. New editor created for more complicated navigation scenarios Disadvantages over the advantages are output devices cannot be altered and system cannot accommodate various input and output devices.
5	Catia Prandi Giovanni Delnevo Chiara Ceccarini 2018	On augmenting the experience of people with mobility impairments while exploring the city: A case study with wearable devices	Use of accessibility Points of Interest (aPOIs) such as [9] LIKE, DISLIKE, AVOID. Smart glass has binocular, transparent, wearable display, Wi-Fi &Bluetooth connectivity. Considering aPOIs the user is navigated. Smart bracelet communicate the direction using vibrations. Say one time vibration for right turn, three times for left turn, five times for a wrong direction.	Output devices can be varied from Google glass to MI band. Mobility impairments can be changed easily. Smart glasses are quite heavy and cannot be used daily. For complicated scenarios vibrations are not very effective.

4. EXISTING SYSTEMS

The existing system are for navigational wearable devices are as follows:

4.1 Navigational Jacket

Wearable X leading fashion Technology Company has developed its latest flagship jacket called NAVIGATE. The NAVIGATE Jacket helps the wearer find her destination using integrated LED lighting and haptic feedback.[7] The companion app stores relevant destinations and uploads the directions to the jacket which gives turn by turn directions. Then the wearer can walk unimpeded with instructions being visualized on the sleeves of their jacket. Stylishly designed with NAVIGATE features tailored into the sleeve, the lights indicate how far to the next turn and the current stage of the journey. Vibrations alert the user when to turn and in which direction.

Fig -1: Smart Jacket

4.2 Navigational Helmet

SKULLY a start-up company was established to improvise the helmet section in the two wheeler class. An add-on advantage of embedded GPS navigation system is an improvement in its class. Additionally this helmet provides information about current vehicle speed, speed limits in that region, and a rear view mirror camera with heads up display at the bottom of the wiser. Also assisting a navigation system information like next fuel up station, traffic information, installed speed camera warning, incoming call notification as well as hands free call receiving through voice assistance using microphone and speakers. This helmet can be paired easily to any smartphone having ios 7 & above or android 6 and above.

Fig -2: Navigational helmet

4.3 Finger Sleeve

The wearable device [1] which will take the task of navigation and help the user to reach their destination. This device does not require any additional information to be downloaded from the internet, therefore, the overhead of data usage is less but maps should be downloaded before starting navigation. This system consists of android based smartphone application and finger sleeve device. The device connects to a smartphone with the help of Bluetooth so HC- 05 is used alternatively we can use BLE (Bluetooth Low Energy) module. The computational tasks are performed by the ATmega168 microcontroller. Two micro vibrators (left and right) are used to provide vibrational indicator w.r.t direction. This device can be used for visually impaired but unable to detect the obstacles.

Finger sleeve has four modules:

1. HC-05 is used to send and receive data wirelessly to/from an android Smartphone. We can use Bluetooth Low Energy (BLE) module as other alternative

2. Arduino Nano has ATmega168 microcontroller with 16KB memory. It is used to store the code. It runs all computational tasks.

3. Two micro vibrators are used to provide a vibrational indicator with respect to the direction.

Some Pre-requisite Steps:

1. Start the Bluetooth.
2. Pair the Finger sleeve with Smartphone. (Done only once)
3. Enable the GPS of Smartphone.
4. Wear Finger sleeve into the index finger.

Algorithm:

1. Start.
2. Set the destination location on map.
3. Application will automatically draw path over a map
4. Signal the finger sleeve.
5. Start sending navigational signals (directions) to Finger Sleeve.
6. Detect the change in positions of User's current location.
7. Repeat the steps 5 and 6 until the user arrives at the destination or application is explicitly closed.
8. Stop.

Fig -3: Finger sleeve [1] Some other existing systems are

Navigational watch which consists of GPS embedded in the watch which works through Service Provider Network Tower using double signal location for accurate positioning and navigation.

The Sena 30K is not simply a Bluetooth headset, it is an adaptive-mesh communicator: the future of wireless communication. [6] Utilizing two antennae and two separate and dedicated processors, the Sena 30K is both a 4.1 Bluetooth headset and an Adaptive Mesh-Networking device, the two working simultaneously in concert within one low-profile unit to accomplish all your communication and entertainment needs.

5. OUTCOME

Allows vehicle drivers to effectively find the route to their destination. This proposed architecture can effectively satisfy the requirements of smart navigation service. Reduce road

accidents or tragedies, facilitate towards road safety and environment friendliness.

Some advantages are: Reduced time of travel; Proper and efficient navigation system proposed will reduce travel time as the user can solely focus on his driving without too much interaction with current navigation system, Less wastage of Fossil fuels and reducing carbon footprint; Negligible or almost none scenarios of detour can be achieved thus reducing fuel wastage and unnecessary carbon dioxide emission into atmosphere, Reduced risk factor while driving; Attentive driving can be observed due to user friendly navigation wearables thus reducing the probability of accidents android applications.

6. CONCLUSION

From the above conducted study we can conclude that SMART NAVIGATION SYSTEMS mainly comprising of wearable devices have an upperhand over the traditional or the current navigation systems. Smart wearable based navigation has various added advantages like a user friendly system, dependable navigation system and reduced travel time. The proposed system "Heads up display on helmet" has additional feature of storing previously directed route, also Helmet is an essential wearable thing in terms of safety.

REFERENCES

[1] Hemant Bhaskar Surale,"Finger Sleeve: A Wearable Navigation Device", International Journal of Computer Science and Information Technologies, Vol. 6 (1), 2015, 534- 538

[2] Martin Pielot, Susanne Boll, Benjamin Poppinga "PocketNavigator: Vibro-Tactile Waypoint Navigation for Everyday Mobile Devices", 2010

[3] Koji Tsukada, Michiaki Yasumura "ActiveBelt: Belt-type Wearable Tactile Display for Directional Navigation" In Proceedings of UbiComp2004, pages 384–399. Springer LNCS 3205, 2004.

[4] Thomas, Bruce H., and Wayne Piekarski. "Glove based user interaction techniques for augmented reality in an outdoor environment." Virtual Reality 6.3 (2002): 167-180.

[5] Toru Ishikawaa, Hiromichi Fujiwarab, Osamu Imaic, Atsuyuki Okabe, "Wayfinding with a GPS-based mobile navigation system: A comparison with maps and direct experience "Journal of Environmental Psychology 28 (2008) 74–82

[6] https://www.bikeopedia.in/Sena%2030K%20Bluetooth %20Headset

[7] https://www.wearablex.com/pages/navigate

[8] Masakazu Miyamae, Tsutomu Terada, Yasue Kishino, Shojiro Nishio, Masahiko Tsukamoto, "An Event-driven Navigation Platform for Wearable Computing Environments", IEEE conference, Oct 2005

[9] Catia Prandi, Giovanni Delnevo, Chiara Ceccarini "On augmenting the experience of people with mobility impairments while exploring the city: A case study with wearable devices" 2018 15th IEEE Annual Consumer Communications & Networking Conference (CCNC)

[10] Bruce Thomas, Victor Demczuk, Wayne Piekarski, David Hepworth, and Bernard Gunther "A Wearable Computer System with Augmented Reality to Support Terrestrial Navigation" Second International Symposium on. IEEE, 1998.