TECHNIQUES WHICH BRINGS SKYWALK TO PLATFORM

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ABSTRACT: It is an idea which brings the sky walk to platform in railway station. In India we can find skywalk in most of the railway stations. According to survey (Gallup Organization, Hungary) very less people (age around 50-70 years) are using skywalk in railway platform. More percentage of people cross the platform without using skywalks, Which leads more accidents. To avoid these things escalators and passenger lifts are placed in some of the railway stations. As per economy these concept are not feasible. In this paper we presented an idea which brings the sky walk to platform to make use sky walks very effectively. This type of skywalks helps aged as well as handicap people.

I. INTRODUCTION
Many countries including India taken care about the vehicles population. But managing the pedestrians to cross the road was an issue. As a solution to the above issue skywalks were introduced over the roads to cross the roads, very safely without disturbing the traffic. Although same approach is used in the railway stations to move people from one platform to another. it is found that it is not a complete solution for all. Many elder age people and physically challenged people cannot walk through the skywalk, as a solution to this approach manually operated bridges over the tracks came into existence. Manually operated bridges (Rameshwaram railway station, Tamilnadu) requires man power, it is one of the complex parts. As a solution to this an automated bridge has been proposed, which operates automatically without human interruption.

II. RELATED WORK
In the present world crossing a road in metropolitan city is very difficult. To avoid this, government has constructed bridges, underpasses, & traffic signals. In the same manner peoples are facing problem in
railway station’s crossing from one platform to another platform.

Crossing of the railway tracks in railway station is major issue. To overcome all these problem we proposed the system Techniques which Brings Skywalk to Platform. The proposed methodologies includes SPHIT algorithm for data compression & noise removal. When the camera sensor senses the image it sent to nearest controller unit. So mean filter is the basic filter, very simple, intuitive, and easy to reduce noise in images[4]. This filter reduces noise based on the amount of intensity variation between one pixel to another. Mean filter works based on the average value of pixel i.e. replacing each pixel value in image with mean/average value of its neighbors[5][6]. The disadvantage of this filtering technique is data compression is not possible & a single pixel with a very unrepresentative value can significantly affect the mean value of the all the pixels in its neighborhood. Compare to mean filter median filter does a better job of preserving useful detail in the image. Instead of simply replacing the pixel value with the mean of neighboring pixel values it replaces it with the median of those values[6]. The median is calculated by first sorting all the pixel values form the surrounding neighborhood into numeric order and then replacing the pixel being considered with the middle pixel value. The main problem with the median filter is that it is relatively expensive and complex to compute. The wiener filter is the optimal stationary linear filter for images degraded by additive noise and blurring. Here signal and noise is the second order stationary because calculation of the wiener filter based on assumption. The major problem of this filter is data compression of moving objects is not possible and it’s very difficult to adopt in real time projects[4]. This filter is the modification of median and mean filter. Filters have shown excellent performance in suppressing noise. Image pre-processing for almost all the applications of image processing is major challenge. The stepper motor is operated with less voltage in a convenient and reliable manner[1][2].

III. PROPOSED WORK:

In our paper we are proposing a mechanism for automated as well as computer operated bridge over the railway track. This mechanism includes various embedded components along with movable bridge and a camera sensor. These devices communicate each other to exchange some valuable information to take decision. The decision is weather to open or close the bridge. Camera sensor senses the train on the railway track and captures the image of the train. The captured images are transferred to the primary controller, where noise is removed, compressed and sends to the secondary micro controller via GSM. Where image will be compared with the existing image. If match is found, then stepper motor starts based on the information received.

Approach is divided into following phases

(i) Image retrieval or Image capture

(ii) Image noise removal

(iii) Image transmission and Compression

(iv) Stepper Motor Controller

(v) Stepper Motor

(vi) Data transfer

(vii) Decision making

(viii) Programmer

Image retrieval or Image capture:-

When train is moved on the track, the camera sensor senses it and captures the image. Camera used is high resolution camera which can capture the image with 4x zoom capability. Rain, fog and darkness
may trouble sensor, to avoid the complexity high resolution camera which can sense the image in any of these environments.

The Block Matching Algorithm (BMA) consists in partitioning each frame of a given sequence into square blocks of a fixed size (in pixel: 6x6 or 8x8 or...) and detecting blocks displacement between the actual frame and the previous one, searching inside a given scan area. It provides a field of displacement vectors (DVF) associated with. Each block encloses a part of the image and is a matrix containing the grey tones of that image part.

What we have to do is estimating each block position in the previous frame in order to calculate displacements and speeds (knowing $D_t$ between frames). Each block defines in the previous frame, a "scan area", centered in the block center. The block is shifted pixel-by-pixel inside the scan area, calculating a match measure at each shift position. The comparison is aimed at determining the pixel set most similar to the block between its possible positions in the scan area. Among these positions, the scan area subpart defined by its center, will be the matrix with the best match measure.

The size of the scan area should account for the highest possible block displacement between two frames. However, since computation time largely depends on this size, it is convenient to keep it as small as possible. The matching process yields a displacement vector $V'$ between the position of the block in the actual frame and that of the best matching in the previous. In the actual frame, the reflected vector $V' = -V$, applied in the block center represents the block displacement as well as its tracking information.

The DVF matrix contains a vector per each location. DVF has $(image\_rows/N)$-rows and $(image\_columns/N)$-columns, were $N$ is the number of pixel per each block side and $image\_rows$ and $image\_columns$ are the pixel size of the original frame. Therefore, the DVF matrix size is smaller than of original image size. Unfortunately, due to noisy grey tone fluctuations, BMA generates many wrong vectors over static blocks located on the background of the road lane. This is typically handled by biasing the selection of the best matching displacement, towards the null displacement [8]; in particular, a fixed value is subtracted to the mismatch measure calculated for the same position in the previous frame (i.e. the null displacement case). Hence, for those blocks having not a reasonably good matching position within the scan area, the displacement vector will tend to be null. Yet, with this approach the matching process is still carried out over the whole scan area even though the displacement vector turns out to be null. Instead, we have addressed the problem so as to achieve also a significant computational saving. In fact, we calculate first the correlation of a block with the block in the same position of the previous frame (i.e. null displacement) and compare the result with a fixed threshold: if the correlation is higher than the threshold, then the null displacement vector is chosen for the block; otherwise we proceed by calculating the correlation over the scan area and then searching for its maximum value. By using a relatively low threshold we favor null vectors in low textured static areas; moreover we compute just a single correlation step when the vector turns out to be null. We found that this approach is effective in preventing wrong matches within static areas, yielding at the same time a computational saving for the Block Matching Algorithm which is usually of the order of 90%. As mentioned in the introduction,
BMA is very effective in discriminating between close objects.

(ii) Image noise removal:
Various filters are available for removing the noise present in image. Captured image of moving objects may have impulse noise and additive noise; Compared to other filters hybrid filter removes this type of noise effectively.

Hybrid filters:-
Image captured by an object may have noise, hence enhancing the image & removal of the noise is a major problem. To remove the noise from the image various filtering techniques available, which removes the noise from the image & preserves the image details. The image captured by the camera or the object may have various types of noise. Since captured image of moving object may have Gaussian noise or impulsive noise, Hybrid filters are used to remove these types of noise. Hybrid filter is combination of two filter’s median filter and wiener filter arranged in the same order respectively. First impulse noise present in the image is removed by using median filter and then resulting image is passed through wiener filter to remove Gaussian noise present in the image. Gaussian noise is nothing but blueness and the additive white noise the image. These combinations of filters produce the output image equivalent to the original image.

Median filter:-
Impulse noise (01) salt & pepper noise can be removed by using median filter any salt & pepper noise present in the image can be removed without significantly reducing sharpness of the image as

<table>
<thead>
<tr>
<th>75</th>
<th>91</th>
<th>76</th>
<th>77</th>
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</thead>
<tbody>
<tr>
<td>99</td>
<td>79</td>
<td>49</td>
<td>89</td>
</tr>
<tr>
<td>100</td>
<td>121</td>
<td>129</td>
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</tr>
<tr>
<td>44</td>
<td>55</td>
<td>56</td>
<td>77</td>
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</table>

Median value 79
The value of the particular pixel is replaced by the median value, Median value is calculated by sorting the neighbor values around the pixel & selecting the median value from that as shown in the figure.

In the figure pixel value 49 need to be replaced by median value. Median of 49 is calculated by sorting it’s neighbor pixel values in ascending (01) descending order after sorting the median value obtained is 79

Wiener filter
Wiener filter is used for the images degraded by blueness & additive noise. It works on the assumption that the signal & noise processes are second order derivatives

\[ S(U,V) = G(U,V) * (U,V) \]

Where

\[ S(U,V) \] – Original image spectrum
\[ X(U,V) \] – Degraded image
\[ G(U,V) \] is wiener filter
\[ G (U,V) = \frac{H(U,V) Ps (U,V)}{H (U,V)^2 + Pn(U,V)} \]

\[ H (U,V) \] – Fourier transform of the point spread function
\[ Ps (U,V) \] – Power spectrum of the signal process
\[ Pn(U,V) \] – Power spectrum of noise process.

The image obtained after wiener filter is equivalent to the original image which is compared with the original image stored in the memory pixel by pixel if both matches then particular action has to be taken place.

(iii) Image transmission and Compression
SPIHT Algorithm
\[ O(i,j): \] set of coordinates of all offspring of node (i,j); children only
D (i,j): set of coordinates of all descendants of node (i,j); children, grandchildren, great-grand, etc.
H (i,j): set of all tree roots (nodes in the highest pyramid level); parents
L (i,j): D (i,j) \( - O(i,j) \) (all descendents except the offspring); grandchildren, great-grand, etc.

Initialization
\[ n = \log_2 (\text{max} \ |\text{coeff}|) \]
LIP = All elements in H
LSP = Empty
LIS = D’s of Roots

Significance Map Encoding (“Sorting Pass”)

Process LIP
for each coeff (i,j) in LIP
Output \( S_n(i,j) \)
If \( S_n(i,j) = 1 \)
Output sign of coeff(i,j): 0/1 = +/- 
Move (i,j) to the LSP
Endif
End loop over LIP

Process LIS
for each set (i,j) in LIS
if type D
Send \( S_n(D(i,j)) \)
If \( S_n(D(i,j)) = 1 \)
for each (k,l) \( \in O(i,j) \)
output \( S_n(k,l) \)
if \( S_n(k,l) = 1 \), then add (k,l) to the LSP and output sign of coeff: 0/1 = +/- 
if \( S_n(k,l) = 0 \), then add (k,l) to the end of the LIP
endif
endif
else (type L ) 
Send \( S_n(L(i,j)) \)
If \( S_n(L(i,j)) = 1 \)
add each (k,l) \( \in O(i,j) \) to the end of the LIS as an entry of type D
remove (i,j) from the LIS
end if on type
End loop over LIS

Refinement Pass

Process LSP
for each element (i,j) in LSP – except those just added above Output the nth most significant bit of coeff. End loop over LSP

Update
Decrement n by 1
Go to Significance Map Encoding Step

Adaptive Arithmetic Code (Optional)

iv) Stepper Motor Controller

<table>
<thead>
<tr>
<th>TABLE 1</th>
<th>COMPARISON OF CONTROLLERS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dimensions</strong></td>
<td>Raspberry Pi B+</td>
</tr>
<tr>
<td></td>
<td>85 X 56 X 19.5mm</td>
</tr>
<tr>
<td><strong>Video</strong></td>
<td>HOMI, Direct LCD</td>
</tr>
<tr>
<td><strong>Audio</strong></td>
<td>Stereo o/p</td>
</tr>
<tr>
<td><strong>RAM</strong></td>
<td>512 MB</td>
</tr>
<tr>
<td><strong>Power Consumption</strong></td>
<td>5V + 600MA (-3W)</td>
</tr>
<tr>
<td><strong>Price</strong></td>
<td>$35.95</td>
</tr>
<tr>
<td><strong>Processor</strong></td>
<td>700 MH2</td>
</tr>
<tr>
<td></td>
<td>ARM Dual core</td>
</tr>
<tr>
<td><strong>USB</strong></td>
<td>4 Ports</td>
</tr>
<tr>
<td><strong>WIFI</strong></td>
<td>None (X)</td>
</tr>
<tr>
<td>Architecture</td>
<td>ARM</td>
</tr>
<tr>
<td>--------------</td>
<td>-----</td>
</tr>
<tr>
<td>band</td>
<td>802.11</td>
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</table>

We choose Raspberry Pi B+ board to control the stepper motor based on the above comparisons it is reliable, can operate through asynchronous signals, cost effective, efficient, fault tolerant and supports SD card as it’s external memory.

Raspberry Pi is a fully functional computer. It has all the trappings of a computer, with a dedicated processor, memory, and a graphics driver for output through HDMI. It even runs a specially designed version of the Linux operating system. That makes it easy to install most Linux software, and lets you use the Pi as a functioning media streamer or video game emulator with a bit of effort. Though the Pi doesn’t offer internal storage, you can use SD cards as the flash memory for the entire system, allowing you to quickly swap out different versions of the operating system or software updates to debug. Because of the device’s independent network connectivity, you can also set it up for access via SSH, or transfer files to it using FTP.

Raspberry Pi uses an applications processor. There are some things a Raspberry Pi is better for (you can hook a Raspi up to a TV, for example), and loads of things an Arduino is more suited to. There’s a good potential marriage between the Arduinos you might have in your drawer at home, and your Raspberry Pi, which you can use to drive them.

In simple terms - the Raspberry Pi is running an OS, which is doing a bunch of OS-like things in the background, like flushing buffers, and system logs, and stuff like that. These things happen periodically, and will interrupt your code. With normal software, you don’t notice this interruption because it's happening at a timescale much lower than a human can tell. However, with a quadcopter, there are processes that shouldn't be interrupted (like the part that collects IMU data). You don't have much control over this interruption (because a multi-tasking OS is designed like this), and so the only way to use a Raspberry Pi to fly a quadcopter is to build hardware buffers into the IMU module, and write code to compensate for non-updating PID output.

v) Stepper Motor

Stepper motor is connected to the controller using asynchronous transfer mode. Physically stepper motor is connected with the metallic bridge for horizontal movement based on the decision taken by the controller. Based on the available data and comparison made some decision will be taken either to move the bridge towards track or to take the bridge back whenever it is not required (or) train arrives. Controller enables stepper motor by using asynchronous signal and activates it.

Stepper motors have input pins or contacts that allow current from a supply source (in this application note, a microcontroller) into the coil windings of the motor. Pulsed waveforms in the correct pattern can be used to create the electromagnetic fields needed to drive the motor. Depending on the design and characteristics of the stepper motor and the motor performance desired, some waveforms work better than others. Although there are a few options to choose from when selecting a waveform to drive a two phase PM stepper motor, such as full-stepping or micro-stepping, this application note focuses on one called half-stepping, which uses four signals. These signals can be produced by a dedicated stepper driver or a microcontroller. Each signal (a, a, b, b) is applied to
a coil terminal. Because each coil has two terminals, two signals must work together to drive a single coil. It is worth noting that the individual waveforms (a, a, b, b) directly from the microcontroller pins to the coil terminals only vary from 0 V to +5 V. However, the effective signal (A, B) applied to the coil varies from −5 V to +5 V, and has positive and negative duty cycles. Two of these effective waveforms 90 degrees out of phase can be used to drive the PM stepper motor. Both waveforms are applied to the motor simultaneously. Each transition in one of the waveforms corresponds to a state change (movement) in the motor. A step by step description of how these particular waveforms work together to move the motor shaft follows. When coil signal A is positive and coil signal B is zero, current flows into coil A through terminal a and out of terminal a. This generates a north-pole electromagnetic field toward the magnetic disk, which repels the nearest north-pole section on the disk and attracts the nearest south-pole section. These forces cause the motor to rotate in a direction that will align opposite poles. Coil B is not energized.

**NOTE** The orientation of the rotor prior to energizing a single coil may be unknown. It is even possible that initially the rotor may not turn because the magnetic forces of the coil could be equally divided over pushing and pulling the north and south pole of the PM disk. If this happens, then moving to the next sequential step by energizing both coils should help jolt the rotor free.

![Digital waveform](image)

**Fig 1: Digital waveform**

vi) Data transfer:

Communication mechanism is enabled between the two devices by using GSM module. Once relevant data from the camera sensor is obtained it enables the transfer of the appropriate information to the main microcontroller for further processing. Once data packets are ready to be transferred it enables GSM module which is placed in raspberry pi controller. Transfer of packets takes place in the form of 1024 bytes using wireless GSM mechanism.

vii) Decision making:

Based on the data received from the camera sensor it checks or compares with the images available in the secondary storage of raspberry pi controller. Once image match found with the existing image decision is taken based on the movement of the train. If the movement of the train is towards the station then the bridge placed over the tracks must be opened. If the train is away from the station then the decision has to be taken in such a way that bridge has to be closed over the track.

```
Void Bridge(packet* new_packet)
```
viii) Programmer

The superpro is a series of cost-effective, reliable, and high-speed universal programmers. They are designed to communicate through a USB or parallel port (model dependent) and to operate with most desktop computers and notebook computers. Their menu-driven software interface makes them easy to operate.

Programming hardware includes the following items:

A programming module (including a 40 or 48 pin ZIF). An AC adapter w/ dual range switching power supply (model dependent) A USB or parallel connecting cable. Optional socket adapters to accommodate PLCC, TSOP, SOIC, SOP, QFP, TSSOP and BGA package types are available.

Software includes the following features:

Supports Windows 95/NT/2000/XP Programming support for a large number of devices (1500-11000) including PROMs, E/PROMs, PLDs and MCU from more than 100 manufacturers (model dependent). Support formats in Binary, Intel (linear & segmented) Hex, Motorola S, Tektronix (linear & segmented), Jed, POF etc. Device insertion test (48 pins or less) to detect defective chip, improper inserted device and loose contacted pin (model dependent) Integrated full screen buffer editors with commands for fill, copy, move, swap, etc. Auto-generation of electronic serial numbers (model dependent) Project and selecting history

Reciprocating Rack Mechanism

Fig 2: Rack and pinion set

Rack and pinion set mechanism has been used to slide the metallic bridge over the tracks to connect to two different platforms. Rack and pinion sets are normally used for linear motion abounds, which can be controlled either by stepper motor or servo motor. Pinion is the one with gear set connected to the motor, converts’ rotator motion to linear motion by moving on the parallel rack. The rack and pinions are paired each other with specific number of gear sets and tooth. The roller pinion present on the motor rides on the rack to enable the linear motion of the rack. The manufacturer designs the rack and pinion tooth in such a way that, they mesh each other in the space allocated to them. The rack is connected with the metallic plate which is capable of bearing some tons of load on it. This rack and pinion mechanism used here is highly cost effective, reliable, easily converts rotator motion to linear motion and suitable for straight approaches. The movement of the metallic plate takes place on the track which is placed slightly above the track without disturbing the train movement. Movement takes place without any lubricants and it is 99 percent efficient. Rack and pinion is connected as shown in the figure, pinion is connected to the stepper motor and rack slides on it. Based on the
direction of the stepper motor rack makes it’s movement. It can perform better with high loads and in high speed than any other system (bearing based systems). Hence rack and pinion is used as a solution to the linear movement of the bridge over the track.

IV. RESULTS

As shown in the Fig3 rack and pinion is connected to the stepper motor controller and it is operated from the system. Stepper motor controller is operated with a voltage of 12volts. Fig4 shows the rack and pinion set being operated. Light indicators are used in the stepper motor controller to indicate the operation of the stepper motor. Stepper motor is programmed in such a way that it can operated in two directions, clockwise and anticlockwise depending on the need. It is connected to the system over a serial bus interface and operated from it. Voltage regulations and power regulations are managed in a controlled manner.

Based on the proposed approach
• Bridge can be moved horizontally over the track when no train arrives to the station and no train is in the station.
• Bridge can be brought out when train is approaching to the station.
This can help many elder and physically challenged peoples to cross the track easily.

Limitation:
If one train is already in platform number one people cannot go to platform number two and vice-versa. But some extent we can avoid the problem of climbing the skywalk.

V. CONCLUSION

Sky walk was the way to move from one platform to another platform, which cannot be climb by physically challenged & elder people. A new technique proposed in this paper brings the skywalk to the platform and overcomes the drawback. Automated skywalk approach over the tracks enables elder people and physically challenged people to cross the platform without using the skywalk built for general purpose. An automated movement mechanism is efficient, cost effective
prevents people from walking on the tracks and avoids accidents.

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